COMPARATIVE STUDY ON ANALYSIS OF VITREOUS HUMOUR AND SYNOVIAL FLUID IN DETERMINING POSTMORTEM INTERVAL (TIME SINCE DEATH)

Dissertation submitted in partial
fulfilment of the requirements for the degree

M.D.,(Forensic Medicine)
BRANCH-XIV

INSTITUTE OF FORENSIC MEDICINE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

THE TAMIL NADU
Dr. M.G.R MEDICAL UNIVERSITY
CHENNAI

APRIL 2016

BONAFIDE CERTIFICATE

This is to certify that the work embodied in this dissertation entitled **"COMPARATIVE STUDY ON ANALYSIS OF VITREOUS HUMOUR AND SYNOVIAL FLUID IN DETERMINING POSTMORTEM INTERVAL (TIME SINCE DEATH)"** has been carried out by Dr.S.Angayarkanni , Postgraduate student under my supervision and guidance for her study leading to Branch XIV M.D., Degree in Forensic Medicine during the period of November 2014 to September 2015.

DEAN,
Madras Medical College
Rajiv Gandhi Govt. General Hospital
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DIRECTOR AND PROFESSOR
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DECLARATION

I, Dr. S. Angayarkanni, solemnly declare that this dissertation titled "COMPARATIVE STUDY ON ANALYSIS OF **VITREOUS HUMOUR AND SYNOVIAL FLUID IN DETERMINING POSTMORTEM INTERVAL (TIME SINCE DEATH)"** is the bonafide work done by me under the expert guidance supervision of **Prof**.**Dr.R.Vallinayagam,** Director and Head of the department, Institute of Forensic Medicine, Madras Medical College, Chennai-3.

This dissertation is submitted to The TamilNadu Dr.M.G.RMedical University towards partial fulfilment of requirement for the award of M.D.,Degree (Branch XIV) in Forensic Medicine.

Place: Chennai **Dr.S.Angayarkanni**

Date: 26.09.2015

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INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
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CERTIFICATE OF APPROVAL

To
Dr. Angayarkanni S,
Postgraduate M.D. (Forensic Medicine),
Madras Medical College,
Chennai - 600 003.

Dear Dr. Angayarkanni S,

The Institutional Ethics Committee has considered your request and approved your study titled **"Comparative study on analysis of vitreous humour and synovial fluid in determining postmortem interval (time since death)". No.10112014.**

The following members of Ethics Committee were present in the meeting held on 11.11.2014 conducted at Madras Medical College, Chennai-3.

1. Dr.C.Rajendran, M.D.,	: Chairperson
2. Dr.R.Vimala, M.D., Dean, MMC, Ch-3	: Deputy Chairperson
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12. Tmt.Arnold Saulina, M.A., MSW.,	: Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

VICE PRINCIPAL
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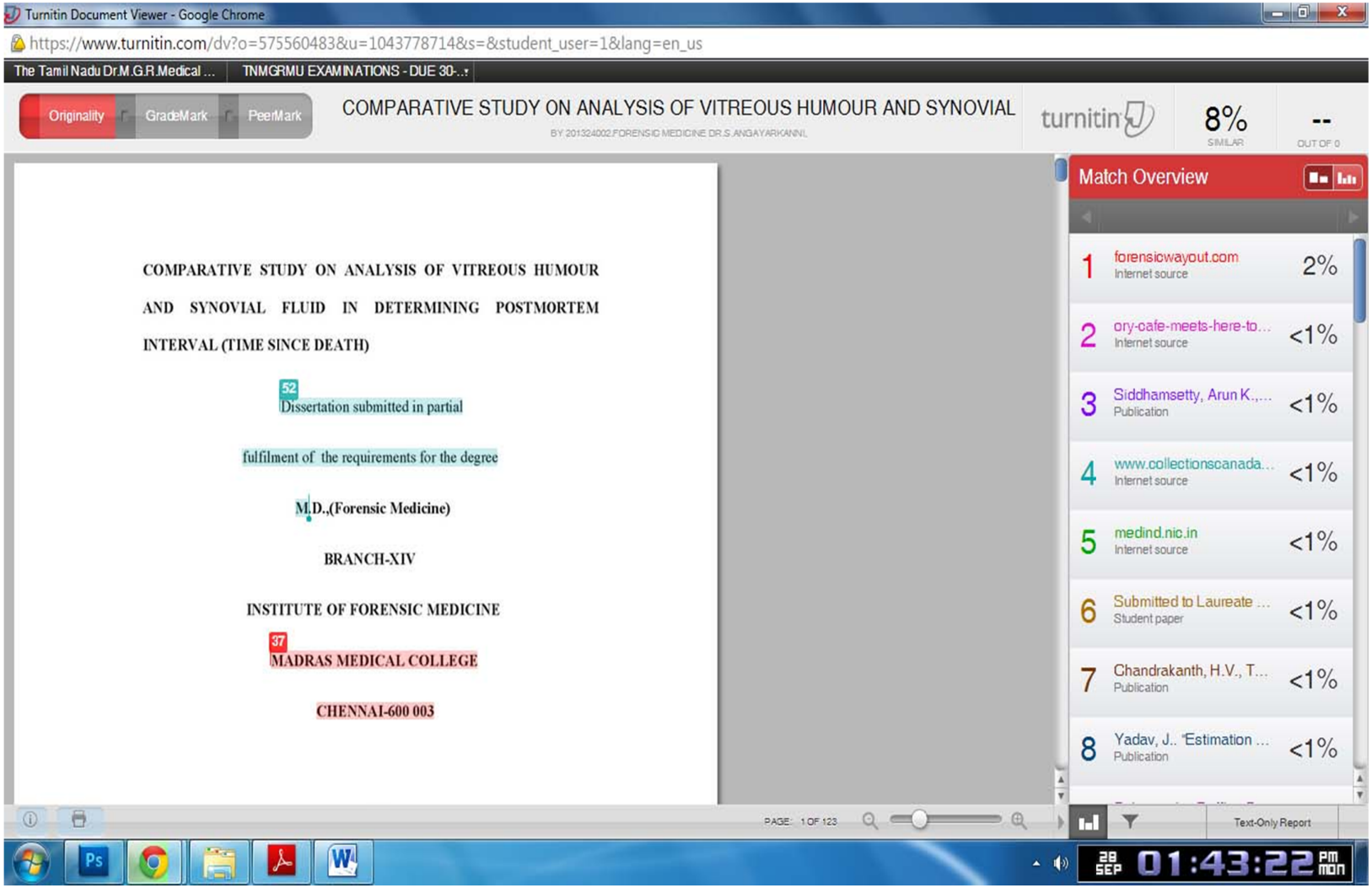
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LIST OF ABBREVIATIONS

TSD	-	Time since death
Hrs	-	Hours
cc	-	Cubic centimeter
%	-	Percentage
mEq/L	-	Milli equivalent per liter
mEq/kg	-	Milli equivalent per kilogram
mmol/l	-	Milli mol per liter
ie.	-	that is
PMI	-	Postmortem Interval
K^+	-	Potassium
Na^+	-	Sodium
±	-	Plus or minus
°C	-	Degree centigrade
nm	-	Nanometer
3-MT	-	3-methoxytyramine
mg/dL	-	Milligram per deciliter
CZE	-	Capillary zone electrophoresis
ANN	-	Artificial neural network
&	-	And
ISE	-	Ion selective electrode
S.No	-	Serial number
Rt	-	Right
Lt	-	Left
Std	-	Standard

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ABSTRACT FOR THE DISSERTATION TO BE SUBMITTED TO THE TAMILNADU Dr M.G.R MEDICAL UNIVERSITY, CHENNAI FOR APRIL2016 M.D.FORENSIC MEDICINE EXAMINATIONS

TITLE: COMPARATIVE STUDY ON ANALYSIS OF VITREOUS HUMOUR AND SYNOVIAL FLUID IN DETERMINING POSTMORTEM INTERVAL (TIME SINCE DEATH)

Abstract:

Post mortem interval is the interval between the death and time of examination of a body. This is important in knowing when the crime was committed. It helps police to start their inquiries with the available information and also in dealing the cases more efficiently. It also helps in including and excluding the suspects and culprits and in confirming the statements of the suspect. Estimation of time since death is useful in civil cases such as inheritance of property, insurance claims etc.

Longer the post mortem interval, wider will be the limits of probability. Though the changes like cooling of body, eye changes, post-mortem staining, rigor mortis, stomach contents, bladder and bowel contents, decomposition changes and circumstantial evidence can sometimes yield a reasonable accurate result in early post-mortem hours, they are not reliable because of environmental factors. Hence forensic pathologists and biochemists have been concentrating on biochemical changes that occur in body fluids such as blood and compartmental fluids like vitreous humour, cerebrospinal fluid, pleural fluid, pericardial fluid and synovial fluid.

Estimation of concentration of potassium in vitreous humour is the most widely used method. Both vitreous humour and synovial fluid are isolated and well protected from injury and decomposition. Analysis of synovial fluid in determining time since death is as accurate as that determined by vitreous humour.

Materials and methods:

This study was carried out on 100 cases which were brought for medico legal autopsy at Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai-3. Cases which were admitted in hospital and whose exact times of death were known were selected for the study. Details of these cases were obtained from the hospital records, police records, relatives and friends. Cases whose exact time of death was not known and with previous history of eye or orbital injury or surgery, posterior segment diseases, joint diseases, previous injury or surgery were excluded from the study. Samples were collected from both vitreous humour and synovial fluid. First sample was collected as early as possible after the entry of the body into mortuary and second sample was taken at the time of post-mortem examination. The samples which were turbid and mixed with blood were discarded.The samples were sent to the Institute of Biochemistry, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai -3 and were analysed by Medica Easylyte Sodium/potassium analyzer.

Conclusion:

It has been concluded from this study that there is a linear correlation between time since death and the potassium levels in samples collected from right and left vitreous humour and synovial fluid at different time intervals. There is no significant difference in the values of samples from both the sides. There is also no significant difference between the values of vitreous humour and synovial fluid. The study also concludes that the sodium values are not statistically significant and shows negative correlation with time since death.

Keywords:

Post mortem interval, vitreous humor, synovial fluid, potassium, sodium, Medica Easylyte Sodium/potassium analyzer.

INTRODUCTION

'Forensic Medicine' or 'Legal Medicine' is the application of knowledge and principles of medicine for the purpose of law, both civil and criminal. Its main objective is to aid in the administration of justice[1].

Forensic experts summoned to the scene of death are aimed to provide an estimation of the time elapsed since death. In forensic medicine and thereby criminal law, the important problem is to estimate the time of death. In the court of law, a medical practitioner has to give evidence as a medical jurist in order to prove the innocence or guilt of an accused. He has a great responsibility that he may be the only reliable evidence in the court of law[2.]

Post mortem interval is the interval between the death and time of examination of a body. This is important in knowing when the crime was committed. It helps police to start their inquiries with the available information and also in dealing the cases more efficiently. It also helps in including and excluding the suspects and culprits and in confirming the statements of the suspect. Estimation of time since death is useful in civil cases such as inheritance of property, insurance claims etc[3.]

Longer the post mortem interval, wider will be the limits of probability. Though the changes like cooling of body, eye changes, post-mortem staining, rigor mortis, stomach contents, bladder and bowel contents, decomposition changes and circumstantial evidence can sometimes yield a reasonable

accurate result in early post-mortem hours, they are not reliable because of environmental factors. Hence forensic pathologists and biochemists have been concentrating on biochemical changes that occur in body fluids such as blood and compartmental fluids like vitreous humour, cerebrospinal fluid, pleural fluid, pericardial fluid and synovial fluid[4].

Because of the lack of oxygen in the circulation, alteration in the enzymatic reaction and stoppage of production of metabolites, extensive biochemical changes occur in all body fluids. Such changes provide chemical markers which help to determine time of death accurately[5.]

These metabolites are products of metabolism and intermediates of smaller molecular size which have functions in normal growth and development of cells. They may be exogenous or endogenous changes and hence metabolite profiles are altered following death[6]

The changes that occur after death have been identified and attributed to agonal period, changes in the early post-mortem period and diffusion of substances between various body fluids.

Biochemical markers are divided into two classes - metabolites and proteins. Sodium, potassium , chloride , calcium , magnesium , phosphate , lactic acid , hypoxanthine , urea , creatinine , uric acid, ammonia , catecholamines , ethanol are metabolites. Other class includes total proteins and enzymes aspartate aminotransferase and lactate dehydrogenase.

Immediately after death, the changes that occur in the chemical composition of body fluids such as blood, vitreous humour, synovial fluid and cerebrospinal fluid are described by thanatochemistry. After death, the electrolytes and the chemicals redistribute, cellular integrity is lost, energy dependent trans membrane transportation is absent. Hence it will be difficult to assess post-mortem blood samples. Because of the breakdown of the active membrane transport and rapid breakdown of metabolism after death, only stable analytes can be estimated in blood samples[7.]

Among the various body fluids like blood, serum, cerebrospinal fluid, aqueous humour, synovial fluid and vitreous humour, estimation of concentration of potassium in vitreous humour is the most widely used method[8.]

Vitreous fluid is an acellular , transparent, inert, colourless , hydrophilic viscous fluid that is present between the lens and retina within the eyeball which is an important supporting structure that serves the optical function. Its weight is approximately 4 grams and its volume is approximately 4 cc. It is composed of 99% of water with soluble proteins, amino acids, low molecular weight constituents, glucose, type II collagen, hyaluronic acid, inorganic salts and ascorbic acid[9, 10]

It is more than 40 years that the biochemical changes in vitreous have been on analysis. The underlying principle in analysing vitreous humour is that

it is a closed compartment which is separated from the rest of the body. But ambient temperature may influence.

The composition of the vitreous is closely related to that of serum, aqueous humour and cerebrospinal fluid. It is relatively stable, easily accessible, less susceptible to rapid chemical changes, well protected from decomposition and contamination. Hence it is more suitable for analysis than other fluids in estimating time since death[11.]

Eye and thereby Vitreous humour is well protected even in case of severe head injury and in burns. This was frequently remarked as "miraculous Escape"[12.]

Many studies have been conducted on analysis of sodium and potassium in vitreous humour.[13, 14, and 15]

Concentration of sodium, potassium and urate were analysed in vitreous humour of both the eyes at the same time of death showed variation between the eyes[16.]

Many studies have shown that the vitreous potassium level increases with increase in post-mortem interval[4,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,,34,35,36,37,38,39,40,41.]

A similar compartment to vitreous humour which is also isolated and protected from injury and decomposition is the synovial fluid. Synovial fluid

may be analysed in cases of severe trauma to eye, severe burns and decomposition where the integrity of the globe is lost. The reliability of examining the synovial fluid when compared to other fluid compartments was compared in certain studies[24.]

Synovial fluid is a stringy thick fluid found in synovial joint cavities. Synovial fluid is made up of proteinases, collagenases, hyaluronic acid and lubricin. Both synovial fluid and vitreous humour were taken and analyzed for sodium, potassium, chloride, creatinine, calcium, urea and glucose which showed comparable values. In determining time of death, the study on synovial fluid revealed as accurate as that studied in vitreous humour[42]

Many studies were carried out in analyzing the biochemical changes in synovial fluid after death[43, 44, and 45.]

There was a linear relationship of increase in potassium concentration with increase in postmortem interval [46.]

The changes in biochemical parameters in synovial fluid is environmental driven and is slower than in blood and cerebrospinal fluid. As the post mortem interval increases, the potassium also increases whereas there is negative correlation with sodium and no correlation with chloride and calcium[47]

Sodium concentration in normal body is 136-145 mEq/L. Potassium concentration in normal body is 50-55 mEq/kg of body weight of which 160

mmol/l ie. 98% of the potassium exists within cell whereas extracellular concentration is 3.5-5.5 mmol/l [50.] The normal sodium value in vitreous humour is 118-124 mmol/L and potassium value in vitreous humour is 2.6-4.2 mmol/L[4.] Potassium is actively transported from ciliary body into anterior vitreous and posterior chamber. Potassium is also contributed by the lens[50.]. Sodium and potassium concentrations in synovial fluid will approximate that of the serum as synovial fluid is an ultra-filtrate of plasma[51.]

Review of Literature

REVIEW OF LITERATURE

Naumann (1959)[17]- This study was carried out on 211 human vitreous samples which demonstrated an increase in potassium concentration after death but correlation with time since death was not attempted.

Jaffe(1962)[17] – This study was carried out on 31 cases with the exclusion of electrolyte imbalance and renal disease and concluded a consistent rise in the level of potassium shortly after death which continued for 125 hours. It also showed there was no significant difference between bodies kept at room temperature and those refrigerated.

Adelson , Sunshine , Rushforth , Mancoff et al (1963)[17]- This study was carried out on 269 cases of which 349 vitreous samples were obtained . They noted a linear relationship between post-mortem interval and vitreous potassium concentration. This study also noted a wide variation in the potassium values in cases of chronic illness than in cases of acute trauma and established individual variations in potassium rise which were not dependent on environmental factors. This study also noted that the potassium levels obtained from both eyes at the same time had no significant difference.

Sturner alone (1963) and Sturner and Gantner (1964)[17]- This study was carried out on 91 cases of which 37 were hospital cases and 54 were coroner's cases. Vitreous samples were taken from both the eyes in 15 cases out of 54 coroner's cases. Study revealed an average difference in both eyes

and a linear relationship between post-mortem interval and the potassium values. It also showed a greater variation in samples obtained from acute deaths in hospital cases than in coroner's cases.

From this data, Sturner developed an equation which has been widely used.

PMI in hours = 7.14 x K+ (mEq/L)-39.1

Where PMI = Post-mortem interval and

K+ = Vitreous potassium concentration.

Hughes (1965)[19] - This study was carried out on 135 cases. Vitreous humour drawn from both the eyes at the same time showed identical values. This study varied greatly from that of Sturner's with a confidence limit of 95% in approximately ± 20 hours. There was a biphasic linear pattern in values obtained from sudden death cases.

Hansson, Votila, Lindfors et al (1966)[20]- This study was carried out on 108 cases with time since death more than 250 hours. Analysis of vitreous potassium showed an increase in values upto 120 hours and then levelled off.

Leahy and Farber (1967)[22,48]- This study was carried out in analysing vitreous potassium derived from 52 cases. The vitreous potassium values ranges from 4.44 to 16.6 mEq/L. In 12 cases where death is sudden, there was no relationship between post-mortem interval and vitreous potassium concentration.

Lie (1967)[21]- This study was carried out on 88 hospital cases using Sturner's formula in determining relationship between vitreous potassium levels and post-mortem interval. There was a linear relationship and the study also included samples collected from both the eyes at the same time and revealed no appreciable difference. He also stressed not to aspirate the vitreous forcibly in order to get accurate results.

Coe (1969)[8]- This study was carried out on 160 cases with normal ante mortem electrolyte and urea nitrogen values. It showed there was a more rapid increase in potassium levels in first few hours of death. In the first day after death a 95% confidence limit was approximately ±12 hours which would increase with increasing post-mortem interval agreeing with Hansson that the standard error increase with increasing post-mortem interval. The study also included independent analysis of vitreous samples taken from each eye at the same time and found nearly identical values.

Bito and Salvador (1970)[17] found linear increase in potassium concentration with increasing post-mortem interval in aqueous as well as vitreous humour in rabbit eyes. It compared the difference in eyes incubated at 3ºC with those incubated at 37ºC.

Adjutantis and Coutselinis (1972)[17] determined the post-mortem interval by developing a method where specimens from two eyes were taken at different time intervals and developing a slope from the two values at zero

hour. This method was hoped to overcome the individual variations in the procedures.

Coe (1973)[8,25] established a rapid increase in potassium levels in vitreous humour than the predicted value in people dying in hot environment and developed a steeper slope for rise in vitreous potassium.

Crowell and Duncan (1974)[48] - This study was carried out on analysing vitreous from the eyes of 60 dogs in correlating post-mortem interval with the potassium concentration and observed an interesting finding that the weight of the dog had influenced the potassium concentration.

Komura and Oshiro (1977)[27]-This study was conducted on 90 humans and 30 rabbits to demonstrate the influence of temperature on vitreous potassium concentration and found a linear correlation between them and the steepness of the slope was more in ambient temperature of 26ºC to 29ºC than in between 13ºC to 17ºC.

Gregora, Kratochvil, Vavrova et al (1978)[17]-This study was carried out on 47 cases who were sent for post-mortem examination in estimating the potassium and calcium ratio by employing atomic absorption spectrophotometry. Proportion of potassium and calcium were found to have linear correlation with time since death. Simultaneous estimation of both the elements enabled more precise determination of time since death than estimating one of the elements.

Blumenfeld, Mantell, Catherman et al (1979)[17] - This study was conducted on eyes of 127 children in analyzing the vitreous potassium concentration and establishing its linear relationship with post-mortem interval.95% confidence limit was found to be ±26 hours and hence it was concluded that the vitreous concentration could not be used to establish time of death.

Foerch, Forman and Vye (1979)[17]- This study reported a linear correlation between time since death and concentration of potassium but failed to provide 95% confidence limit and the slope of the line.

Henry and Smith (1980)[17,48] - This study was conducted on cadaver fluids like blood , vitreous humour and cerebrospinal fluid in analysing ammonia, creatinine, amino nitrogen, non-protein nitrogen and inorganic phosphates. The study revealed a linear correlation between post-mortem interval and potassium concentration in vitreous humour and also explained the rise independent of influence by environment.

Mason, Harkness, Elton et al (1980)[17] –This study was carried out on subjects of cot deaths in England by analysing the vitreous potassium concentration. Study revealed post-mortem elevation of potassium but failed to provide the linear relationship with post-mortem interval.

Schoning and Strafuss(1980)[48]- This study was carried out on 60 mongrel dogs to find the changes in post-mortem vitreous humour with

increase in time and temperature. The dogs after death were placed for 3, 6, 12, 24, and 48 hours at 4, 20 and 37 ºC. Sodium, potassium , chloride, urea nitrogen, glucose and creatinine were analysed before and after death. The study revealed a linear relation between rise in potassium with time and temperature.

McKoy, Choo-Kang and Escoffrey (1983)[30]- This study was carried out on vitreous samples of 105 cases to analyse potassium level and found a biphasic linear relationship between vitreous potassium concentration and post-mortem interval.

Balasooriya, Hill and Williams (1984)[16]- This study was carried out by analyzing potassium concentration in vitreous humour obtained at the same time from both the eyes after death which revealed a significant change in potassium concentration in vitreous after death which had a linear relationship during first 85 hours. It also showed a difference in values when analysis is made in each eye separately.

Bray (1984)[17] – This study was carried out on vitreous samples of decapitated heads of sheep which were separated into two groups., one group were kept at room temperature and the other group were chilled on ice or ice water. Samples were taken at intervals for a period of 48 hours which showed the result of diminution in the rate of rise of potassium and magnesium in refrigerated eyes.

Coe and Apple (1985)[8] – This study demonstrated the differences in vitreous potassium concentrations by different methods of analysis and reported that the values obtained by flame photometry were lower than that obtained by direct potentiometry with selective ion electrode.

Farmer, Benomran and Watson et al (1985)[31]-This study was carried out in determining the levels of sodium, potassium, calcium and magnesium in post-mortem vitreous samples from 13 fire victims, 10 drowning victims and 61 human controls. The study revealed the limitations by individual biological variation in predicting the post-mortem interval based on the electrolytes in spite of its positive correlation.

Stephens and Richards (1987)[33]- This pilot study was carried out on 1427 cases which included even the new born infants. Vitreous samples were analysed by flame photometry as well as direct potentiometry with potassium ion selective electrode. The study revealed a linear increase in potassium concentration with increasing post-mortem interval. Linear regression equation was obtained statistically. The coefficient of determination was 0.374 which meant that 62.6% of potassium variation was unaccounted for the variation in post-mortem interval.

Madea, Henssge , Honig et al (1989)[23]- This study was done on 170 sudden and hospital death cases of chronic illness. The accurate time of death was known. Vitreous potassium levels between two eyes whose sample were taken simultaneously but determined independently showed a deviation from

the mean of up to 10%. The study showed a linear relationship between the time of death and potassium concentration upto 120 hours. The study considered the duration of terminal episode and the urea concentration determines the precise estimation.

Sparks, Oeltgen , Kryscio et al (1989)[17]- This study was carried out on 91 cases by analyzing vitreous potassium and 3-methoxy tyramine in the putamen of the brain. 95% confidence limit was ± 10.5 hours in case of vitreous analysis. When this was combined with 3-MT levels the confidence limit was ± 8 hours. Hence concluded the most accurate method of determination of time since death was to estimate both vitreous potassium and the 3-MT.

Madea and Henssge (1995)[17]-This study was carried on cases of sudden deaths due to natural cause and due to trauma. Vitreous humour was analyzed for potassium and correlated with time since death. The study explained an increase in potassium concentration in cases with underlying metabolic diseases. The confidence limit was narrowed by excluding cases of metabolic disorders by using creatinine less than 1.0 mg/dL and urea nitrogen less than 70 mg/dL.

The formula proposed by Madea was

$$\text{PMI (hours)} = 5.26 \times K^{+}\ (\text{mEq/L}) - 30.9$$

where PMI = Postmortem Interval

K^+= Potassium concentration in vitreous humour and had the 95% confidence limit of ± 19 hours.

James, Hoadley and Sampson (1997)[17,48]- This study was carried out on 100 cases with known time of death and analysed concentration of potassium and hypoxanthine. The study explained the advantage of analysis of vitreous humour over blood and cerebrospinal fluid. A linear regression equation was obtained which estimated more accurate result than the previous existing equations.

Ferslew, Hagardorn, Harrison et al (1998)[17]-This study compared the analysis of ions by capillary ion analysis technique with ion specific electrode analysis. It revealed a correlation coefficient of 0.9642 in the analysis of vitreous potassium concentration. Possibility of quantization of various cation concentrations in vitreous humour has been established.

Pounder, Carson , Johnson et al (1998)[17,40]- This study was carried out on 200 medico legal cases to find the between –eye differences in electrolyte concentration using an ion specific electrode system. The cases were biochemically classified as non-putrefied , putrefied and as early putrefaction. The study revealed tolerable between – eye concentrations of sodium and chloride. The efficacy of the use of vitreous potassium concentration in estimating time since death has been lessened by erratic and significant between – eye differences.

Tagliaro, Manetto, Cittadini et al (1999)[17] – This study was aimed in optimizing and validating a fast, reliable and simple method of capillary electrophoresis by using ultraviolet detection at a wavelength of 214 nm in analysing the potassium in human vitreous humour. The method found a linearity in the concentration of potassium which ranged from 6.5 mmol to 16.25 mmol with coefficient of determination of 0.9994 and also compared the analysis by capillary electrophoresis and flame photometry.

Munoz, Suarez-Penaranda, otero et al (2001)[17]- This study was aimed in relating the post-mortem interval with vitreous potassium concentration by obtaining a new equation by changing the variables . In this study, the authors considered K^+ as an independent variable and PMI as a dependent variable where in other studies K^+ was considered as a dependent variable and PMI as an independent one. The regression line obtained was $K^+ = 5.35+0.22$ PMI and after changing the variable PMI=$2.58(K^+)$-9.30. Statistically no significant difference was found in potassium concentrations between two eyes.

Bocaz-Beneventi, Tagliaro, Bortolotti et al (2002)[17]- This study was carried out on 61 cases with known post-mortem interval which ranged from 3 to 144 hours. Use of multicomponent capillary zone electrophoresis (CZE) in analysing the potassium, ammonia and sodium ions in vitreous samples in the study and application of artificial neural networks (ANN) in finding the relationship between the concentration of ions and the post-mortem interval revealed a good linear correlation .

Munoz, Suarez- Penaranda ,Otero et al (2002)[17]-This study estimated the relation between post-mortem interval and the potassium concentration and obtained a more precise measurement of PMI by changing the variables , K^+ as an independent variable and the PMI as a dependent variable. They also found that the cause of death as an extra factor which also modifies the relationship.

H.V.Chandrakanth et al 2012[15]. This study was carried out on 114 Medico legal autopsies conducted in Department of Forensic Medicine , JSS Medical College and Mysore Medical College.Cases whose exact time of death (range of 0-36 hours)was known were included in the study. The study was aimed to find differences between right and left eyes and male-female differences. The study did not reveal any correlation between biochemical changes in vitreous humour and time of death. Also it did not observe the statistical significance between right and left eyes and male and female.

S.M.Arikeri et al 2013[48]. This study was carried out on 82 cases out of which 60 were males and 22 were females.11-60 years was the average age in this study. The average time of death is 19.60 hours. The average level of potassium was 5.26 mEq/L and sodium was 109.90 mEq/L. levels of sodium and potassium and the time since death had positive correlation but it was statistically insignificant. But in cases of death due to mechanical injuries, 19.38 hours was the average time since death and there exists a positive

correlation between the levels of sodium and potassium and the time since death and such relation was statistically significant.

N.K.Tumram et al 2014[42,48]. This study was carried out on 308 cases that were admitted in the Govt medical college and hospital, Nagpur whose times of death were known and who was brought for Medico legal post-mortem examination. The cases were of different age, sex and had different time of death. By supra patellar approach, the synovial fluid was aspirated and sent for biochemical analysis. This study established a linear correlation between the synovial fluid potassium and time of death. Regression equation was formulated.

Nishant A.Sheikh[48]- This study was carried on 123 cases of which 82 were males and 41 were females with known time of death in evolving a definite formula relating potassium changes after death in synovial fluid with time since death. This study also correlated the cause of death in relation to time of death.

Arun K Siddhamsetty et al[47]- This study was carried out on two hundred and ten samples of synovial fluid obtained from cases brought for post-mortem examination. It studied the environmental driven rate of change in biochemical parameters. A significant variation in concentration of potassium with time of death was shown. It was also found that there was negative correlation with sodium and glucose and no correlation with chloride and calcium levels.

Munoz JI et al[17]- In their study they obtained a new equation where concentration of potassium is considered to be an independent variable and post-mortem interval as a dependent variable whereas other authors obtained a linear regression using potassium concentration as a dependent variable and post-mortem interval as an independent variable.

Gong ZQ et al[17] – this study was carried over in vitreous humour of rabbits by detecting relationship between 21 elements in vitreous humour and post-mortem interval. The concentrations of 9 out of 21 elements were correlated in determining the time of death.

N.K.Tumram , R.V.Bardale , Dongre A.P[42,48] –This study was carried out on 154 medico legal cases with known time of death. Sodium, potassium, chloride, calcium, glucose, urea were analysed in both vitreous humour and synovial fluid. Study revealed estimation of potassium levels in both the fluids can afford the most accurate method of determination of time since death.

N.K.Tumram , Vipul Namdeorao Ambade, A.P.Dongre,2014[42,48]- This study was carried out on a total of 308 medico legal cases that were sent for post-mortem examination. Synovial fluids were analysed for change in concentration of potassium level. Post-mortem interval ranging from 1.45 to 35.18 hours. The study established a linear rise in potassium with increasing death interval.

Burkhard Madea, Christoph Kreuser, Sibylle Banaschak S 2001[48]- This study analysed sodium, potassium, chloride, urea, creatinine, glucose in both synovial fluid and vitreous humour in 74 cases of sudden death. It compared the values of various analytes in both fluids and found the reliability of synovial fluid as compared to vitreous humour.

Sahoo PC, Mohanty N.K[45]- This study was carried out on 84 cases brought for post-mortem examination. Synovial fluid were collected and analyzed for sodium, potassium and glucose levels. The study revealed the correlation between potassium level and time since death whereas there was no correlation between sodium and glucose with time since death.

Chaudhary e al[41]- This study was conducted on 106 medico legal cases of which 69 were males and 37 were females. Age distribution was ranging from 4 to 85 years and the post-mortem interval from 3 to 72 hours. Vitreous humour potassium was analysed which showed a linear increase with the time since death.

Rognum et al[16] – This study was conducted on 87 subjects of which 54 were males and 33 were females. The mean age was 71.5 years. Four samples were taken in both eyes twice analysed for vitreous potassium which revealed a fairly increasing linear relationship with the time since death.

Mulla et al[16] – This study was done on 103cases of which 35 were females and 68 were males. The mean age was 60.6 years. Post mortem

interval was ranging from 4.5 to 84.3 hours. Vitreous samples were collected from both the eyes and analysed for biochemical constituents. Study revealed no significant between eye differences in any of the constituents.

Vishal[17] studied 24 burn cases and 176 non burn cases. Vitreous was aspirated and analysed for potassium levels. Study revealed a significant increase in potassium levels with increase in post- mortem interval. It also showed there is a significantly higher increase in potassium levels in burn cases.

Jashnani et al[17] - This study was carried out on 120 postmortem cases with age ranging from 15 to 88 years. Maximum post- mortem interval was 50 hours. Vitreous was analysed and it revealed a linear rise in potassium concentration with early post- mortem interval and an increase in scattering in cases with post-mortem interval more than 20 hours.

Aims and Objectives

AIMS AND OBJECTIVES

1. To study the use of compartmental fluids in finding post-mortem interval.
2. To compare the vitreous humour findings with that of the synovial fluid findings
3. To compare the distribution of substances in various body fluids and even between two eyes
4. To determine post-mortem interval even in decomposed and charred bodies.

Materials and Methods

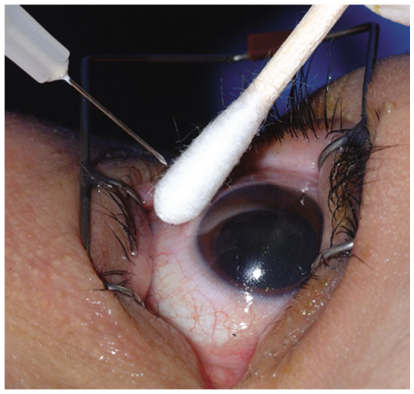
MATERIALS AND METHODS

This study was carried out on 100 cases which were brought for medico legal autopsy at Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai-3. Cases which were admitted in hospital and whose exact times of death were known were selected for the study. Details of these cases were obtained from the hospital records, police records, relatives and friends. Cases whose exact time of death was not known and with previous history of eye or orbital injury or surgery, posterior segment diseases, joint diseases, previous injury or surgery were excluded from the study.

Samples were collected from both vitreous humour and synovial fluid. First sample of vitreous humour was aspirated from both the eyes simultaneously and first sample of synovial fluid was aspirated from both the knees simultaneously as early as possible after the entry of the body into mortuary. Second sample was taken from both the eyes and both the knees simultaneously at the time of post-mortem examination. The samples which were turbid and mixed with blood were discarded .The details of the cases were recorded in the proforma attached.

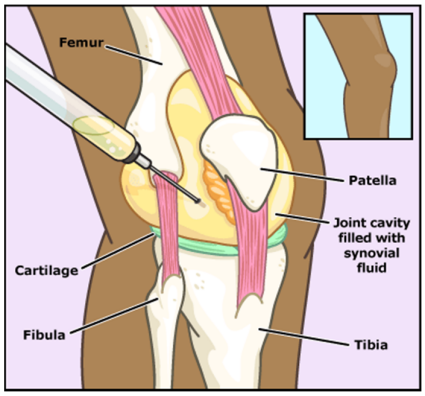
Samples of vitreous humour were collected from the posterior chamber by aspirating gradually and slowly through a puncture 5-6 mm away from the limbus using a sterile 20 gauge needle taking care to avoid tearing of any loose tissue fragments surrounding the vitreous chamber.

Fig.1. Procedure of Vitreous aspiration



Similarly synovial fluid was carefully aspirated from the knee joint using a wide bore needle.

Fig.2. Procedure of Synovial fluid aspiration



The samples were sent to the Institute of Biochemistry, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai-3.

The samples were analysed by Medica Easylyte Sodium/potassium analyser. It is a fully automated, electrolyte system that is microprocessor controlled. It uses Ion Selective Electrode(ISE) technology for the measurement of electrolytes in which are stored, an easily accessible quality

control data. It measures sodium, potassium, chloride, lithium, calcium and pH of the serum, whole blood, plasma, urine, vitreous and synovial fluid. The calibrants are packed in a convenient solution pack with

Standard A solution, 800 ml (140.0 mmol/L sodium *4.0 mmol/L potassium*Buffer*Preservative *wetting agent).,

Standard B solution 180 ml (35.0 mmol/L sodium,16.0 mmol/L potassium*Buffer*Preservative*Wetting agent)

Wash solution, 80 ml (0.1 mol/L (Ammonium bi fluoride) Ion selective Electrode method consists of a thin membrane across which only the intended ion can be transported. The transport of ions from a high concentration to a low concentration through a selective binding with some sites within the membrane creates a potential difference which is measured in Volts.

Fig.3.Medica Easylyte Electrolyte Analyzer

Observations

OBSERVATIONS

This study was carried out on 100 cases whose time of death was known who were brought to the mortuary, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai-3 for post-mortem examination.

Samples of vitreous humour and synovial fluid were taken at intervals. First sample was taken as early as possible after the entry of the dead bodies into the mortuary from both the eyes and from both the knee joints. Second sample was taken at the time of post-mortem examination from both the eyes and from both the knee joints.

Only the clear vitreous humour and synovial fluid were analysed. Turbid or blood stained samples were excluded from the study.

The samples were analysed for sodium and potassium by selective ion electrode method.

Table No.1

This table shows percentage of cases depending upon time since death in sample 1 of vitreous humour of both eyes and sample 1 of synovial fluid of both knee joints.

S. No	Time since Death (hours)	Number of Cases	Percentage of cases
1.	Within 12 hours	53	53%
2.	12.1-24 hours	37	37%
3.	Above 24 hours	10	10%
	Total	100	100%

From table no.1 it was concluded that there were 53 cases with time since death within 12 hours which constituted 53%, there were 40 cases with time since death from 12.1 to 24 hours which constituted 40% and 7 cases with time since death more than 24 hours which constituted 7% out of 100 total cases.

Table No.2

This table shows sodium and potassium levels in right eye vitreous sample 1 and right knee synovial fluid sample 1 with time since death within 12 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	10	133.9	7.2	127.1	5.3
2	4	143.2	6.1	135.4	5.2
3	12	144.2	8.2	146.6	6.3
4	12	149.0	6.8	149.9	7.2
5	10	146.4	7.1	144.7	7.0
6	7	146.2	7.0	138.4	5.8
7	9	152.9	6.1	150.3	7.0
8	11	152.5	7.9	145.6	7.0
9	2	147.3	6.8	150.5	5.3
10	3	157.9	7.5	152.3	6.8
11	9	127.7	9.4	134.2	9.6
12	12	150.9	9.1	147.4	9.1
13	12	145.5	12.2	144.2	12.6
14	12	141.2	11.9	144.5	10.5
15	7	127.7	9.4	134.2	9.6
16	10	155.4	12.7	154.8	11.4
17	8	137.5	12.7	144.5	8.2
18	8	138.5	6.7	138.8	6.4
19	10	139.7	4.8	140.8	5.3
20	10	150.9	9.1	147.4	9.0
21	12	154.2	18.6	153.5	17.9
22	9	147.3	9.2	142.3	8.8
23	2	128.4	3.4	129.5	3.1
24	4	132.5	5.1	133.2	5.3
25	5	129.6	6.4	130.2	5.7
26	3	128.3	4.5	130.2	4.6
27	2	126.5	2.9	128.7	3.2

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
28	11	145.1	7.3	148.0	7.0
29	5	138.9	4.5	136.8	5.4
30	6	138.4	7.8	136.6	7.6
31	12	145.2	7.5	141.2	6.9
32	5	128.9	5.6	127.7	6.2
33	2	128.1	3.8	132.8	3.7
34	3	129.1	4.3	130.1	4.5
35	10	139.9	7.4	138.6	7.0
36	6	130.2	5.0	131.2	4.6
37	2	126.5	3.2	128.8	3.1
38	12	145.2	7.2	142.3	6.8
39	10	142.7	7.2	141.2	6.5
40	3	127.3	4.6	130.2	4.3
41	7	153.4	6.8	149.8	6.5
42	11	143.5	6.7	145.8	6.4
43	4	129.8	6.1	128.4	5.8
44	2	127.6	3.5	129.8	3.6
45	8	138.8	6.9	136.8	6.3
46	5	129.7	5.2	130.1	4.5
47	12	145.6	6.7	146.0	6.4
48	7	130.1	4.9	133.7	4.6
49	7	148.9	6.2	138.2	5.6
50	12	151.1	7.5	145.6	6.9
51	1	127.5	2.9	126.5	2.8
52	6	145.6	6.9	150.2	5.9
53	3	129.7	3.9	132.4	4.2

Table No.3

This table shows sodium and potassium values in right eye vitreous sample 1 and right knee synovial fluid sample 1 with time since death between 12.1 hours to 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	16	141.4	14.6	150.7	10.6
2	18	158.7	6.8	157.0	7.4
3	19	149.0	10.6	145.2	8.4
4	13	155.6	8.8	152.9	7.1
5	13	149.9	8.6	151.1	8.7
6	19	142.6	10.2	137.0	7.6
7	15	145.7	10.7	139.5	9.8
8	18	141.7	9.1	140.7	7.3
9	17	143.2	8.6	137.8	9.9
10	14	153.7	10.6	147.7	9.9
11	17	154.3	7.3	151.7	5.4
12	21	149.9	10.5	152.4	7.9
13	24	144.2	11.9	144.5	11.5
14	18	153.2	7.8	152.9	7.6
15	14	146.9	7.3	148.5	7.0
16	18	135.7	11.3	135.1	9.0
17	20	138.3	9.4	145.1	9.8
18	14	137.2	8.3	132.5	6.6
19	15	149.4	5.8	144.0	5.6
20	15	128.3	7.0	131.9	5.6
21	22	125.1	9.1	123.3	8.0
22	20	158.3	10.5	154.5	9.8
23	15	141.2	8.7	138.9	8.3
24	14	139.8	7.5	136.5	7.2
25	20	134.5	9.7	132.2	8.8
26	18	146.5	7.4	146.0	7.0

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
27	13	143.6	7.5	141.2	6.9
28	13	137.8	7.8	135.6	7.3
29	20	151.2	11.8	149.9	11.9
30	13	141.2	7.5	138.6	7.2
31	17	154.6	8.6	152.6	8.8
32	14	152.2	7.5	148.6	7.7
33	18	139.8	7.5	140.1	7.1
34	15	145.3	7.9	144.3	7.6
35	13	147.8	7.3	151.1	7.9
36	17	150.2	10.2	148.9	9.8
37	18	152.8	7.8	153.9	7.6
38	15	149.8	8.8	148.6	8.5
39	15	134.5	10.5	137.8	9.5
40	13	145.8	7.5	147.6	6.8

Table No.4

This table shows sodium and potassium values in right eye vitreous sample 1 and right knee synovial fluid sample 1 with time since death more than 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	31	147.9	7.2	148.5	7.0
2	27	139.5	10.1	139.7	10.2
3	48	132.7	13.2	132.5	12.9
4	102	125.7	16.3	124.6	15.6
5	29	143.2	8.6	137.8	9.9
6	36	133.8	15.1	136.7	13.4
7	28	138.7	7.3	136.6	6.9

Table No.5

Descriptive for Right side Sample I TSD										
	P value		**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Min**	**Max**
							Lower Bound	**Upper Bound**		
Sample I R Eye Na	P<0.001	<12 hrs	53	139.6623	9.51061	1.30638	137.0408	142.2837	126.50	157.90
		12-24 hrs	40	145.2725	7.76732	1.22812	142.7884	147.7566	125.10	158.70
		>24 hrs	7	137.3571	7.32481	2.76852	130.5828	144.1315	125.70	147.90
		Total	100	141.7450	9.12358	.91236	139.9347	143.5553	125.10	158.70
Sample I R Eye K	P<0.001	<12 hrs	53	6.9509	2.85628	.39234	6.1637	7.7382	2.90	18.60
		12-24 hrs	40	8.9075	1.76394	.27890	8.3434	9.4716	5.80	14.60
		>24 hrs	7	11.1143	3.74941	1.41714	7.6467	14.5819	7.20	16.30
		Total	100	8.0250	2.82311	.28231	7.4648	8.5852	2.90	18.60
Sample I R knee Na	P<0.001	<12 hrs	53	139.2075	8.16444	1.12147	136.9571	141.4579	126.50	154.80
		12-24 hrs	40	144.2100	7.72295	1.22111	141.7401	146.6799	123.30	157.00
		>24 hrs	7	136.6286	7.22812	2.73197	129.9437	143.3135	124.60	148.50
		Total	100	141.0280	8.30111	.83011	139.3809	142.6751	123.30	157.00
Sample I R Knee K	P<0.001	<12 hrs	53	6.5340	2.61482	.35917	5.8132	7.2547	2.80	17.90
		12-24 hrs	40	8.1600	1.50874	.23855	7.6775	8.6425	5.40	11.90
		>24 hrs	7	10.8429	3.29184	1.24420	7.7984	13.8873	6.90	15.60
		Total	100	7.4860	2.57105	.25711	6.9758	7.9962	2.80	17.90

Table No. 6. Regression for Right K Vitreous Fluid Sample 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.450[a]	.202	.194	.56225
a. Predictors: (Constant), Right K Vitreous humour				

Table No. 7.

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.740	.170		4.355	.000
Right K Vitreous humour	.100	.020	.450	4.986	.000
a. Dependent Variable: TIME SINCE DEATH					

Fig.4. Correlation of sample I of right vitreous potassium with time since death

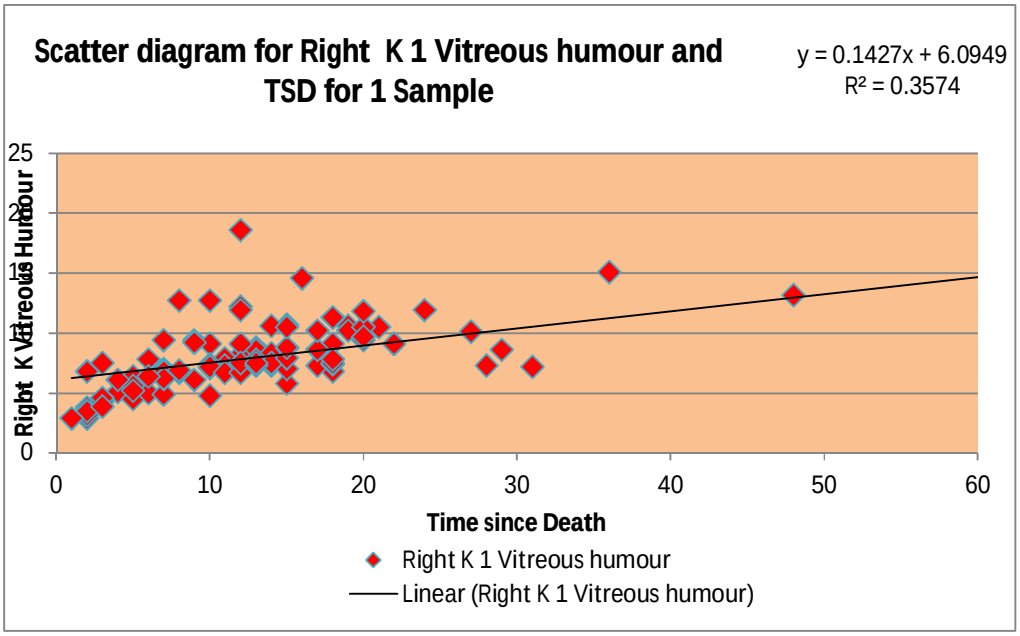


Table No. 8. Regression Right K Synovial Fluid 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.603[a]	.363	.357	9.49771
a. Predictors: (Constant), Right K Synovial Fluid 1				

Table No. 9.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-7.424	2.939		-2.526	.013
	Right K Synovial Fluid 1	2.777	.371	.603	7.477	.000
a. Dependent Variable: Left TSD 1						

Fig.5. Correlation of sample I of right synovial potassium with time since death

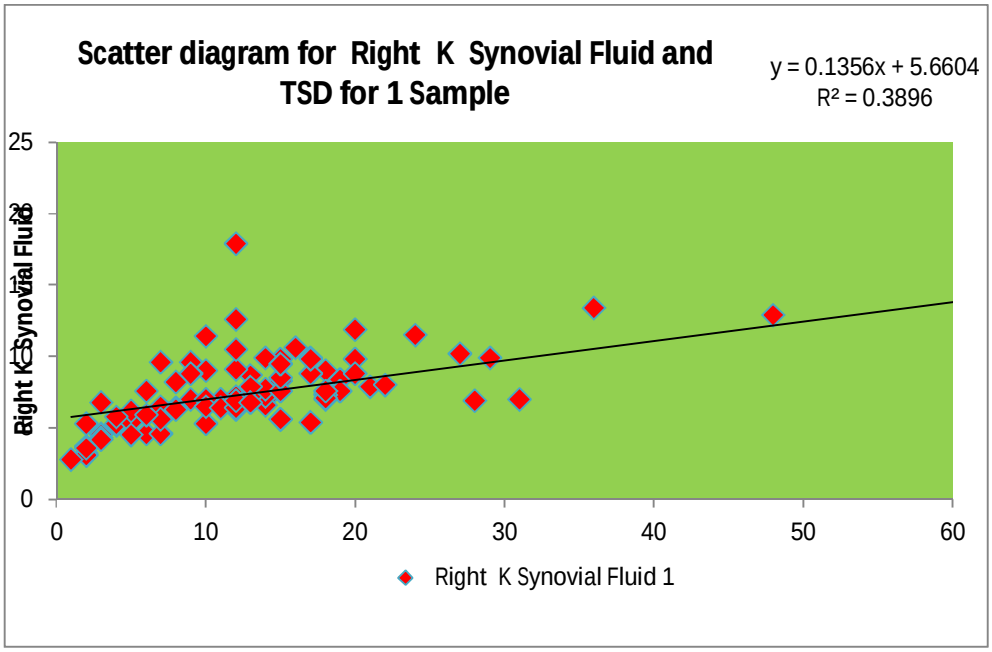


Table No. 10.

Correlation between TSD and Right side Values for sample1

		Right Na 1 Vitreous humour	Right K 1 Vitreous humour	Right Na Synovial Fluid 1	Right K Synovial Fluid 1
TSD	Pearson Correlation	.004	.580**	-.013	.603**
	P Value	.967	.000	.897	.000
	N	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table No.11.

This table shows sodium and potassium values in left eye vitreous sample 1 and left knee synovial fluid sample 1 with time since death within 12 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	10	133.6	7.1	126.9	5.4
2	4	143.0	6.4	142.9	5.1
3	12	143.8	8.1	147.1	6.2
4	12	148.9	7.0	150.5	6.9
5	10	146.6	6.8	145.6	6.8
6	7	147.0	6.5	136.7	6.2
7	9	153.0	5.8	151.8	6.8
8	11	152.8	8.2	150.8	7.2
9	2	147.8	7.0	149.8	6.2
10	3	158.0	7.2	152.5	6.9
11	9	128.4	9.1	135.5	8.9
12	12	151.5	9.5	148.2	9.3

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
13	12	145.6	11.8	146.5	12.2
14	12	140.8	11.4	141.1	11.2
15	7	128.0	9.8	126.8	8.9
16	10	155.1	13.2	154.2	12.2
17	8	138.0	13.2	146.7	8.0
18	8	139.1	6.4	141.2	6.5
19	10	139.7	5.0	138.6	5.1
20	10	150.6	9.0	148.8	8.9
21	12	153.8	18.7	152.8	18.5
22	9	147.1	9.3	147.4	8.9
23	2	128.2	3.2	127.9	3.0
24	4	132.4	5.2	133.1	5.3
25	5	129.8	6.5	130.4	5.8
26	3	127.9	4.7	129.7	4.6
27	2	126.3	3.1	128.5	3.0
28	11	144.8	7.2	146.2	7.0
29	5	140.0	4.6	139.2	4.9
30	6	138.4	7.6	136.7	7.8
31	12	144.9	7.3	140.9	6.5
32	5	130.0	4.2	129.9	4.5
33	2	127.8	3.9	132.6	3.8
34	3	130.0	4.2	129.9	4.5
35	10	140.1	7.3	138.5	7.1
36	6	130.0	5.2	131.1	4.7
37	2	126.4	3.2	129.0	3.2
38	12	145.1	6.9	142.0	6.7
39	10	142.5	7.0	141.6	6.8
40	3	127.1	4.5	130.5	4.2
41	7	152.3	6.5	150.1	6.6
42	11	143.2	6.4	146.0	6.5
43	4	130.1	6.0	127.9	5.9
44	2	127.8	3.7	130.2	3.8
45	8	139.0	6.9	136.5	6.1
46	5	130.1	5.0	130.1	5.1

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
47	12	144.8	6.9	143.0	6.3
48	7	131.2	5.1	132.9	4.9
49	7	149.0	6.1	138.3	5.8
50	12	151.1	7.3	144.9	5.8
51	1	128.1	3.3	126.5	3.1
52	6	145.6	6.2	151.0	5.9
53	3	130.1	4.1	132.5	4.5

Table No.12

This table shows sodium and potassium values in left eye vitreous sample 1 and left knee synovial fluid sample 1 with time since death from 12.1 hours to 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	16	141.6	14.9	15.3	11.0
2	18	159.0	6.7	156.8	7.5
3	19	149.2	10.7	144.0	7.8
4	13	155.9	8.9	153.4	6.9
5	13	150.2	8.4	149.7	8.4
6	19	142.4	10.1	138.4	7.4
7	15	146.0	10.3	141.1	9.2
8	18	142.0	8.6	139.7	6.9
9	17	144.0	8.4	139.4	9.7
10	14	154.0	11.0	145.9	9.8
11	17	154.1	7.7	153.2	6.2
12	21	150.1	9.9	149.8	6.2
13	24	144.1	11.4	144.5	11.7
14	18	153.4	7.5	153.2	7.4

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
15	14	147.2	6.9	149.7	7.1
16	18	136.2	11.1	136.0	9.2
17	20	138.7	8.9	144.8	9.7
18	14	137.4	7.9	137.1	7.1
19	15	150.1	6.3	150.2	6.2
20	15	128.7	7.0	126.5	6.2
21	22	124.8	8.5	124.5	7.9
22	20	158.4	10.0	156.4	9.2
23	15	140.9	8.6	138.4	8.3
24	14	140.1	7.4	135.9	7.1
25	20	134.6	9.5	132.0	8.6
26	18	145.9	7.2	146.2	7.0
27	13	143.8	7.3	140.9	7.3
28	13	138.1	7.6	135.7	7.3
29	20	150.8	11.5	150.0	12.1
30	13	141.0	7.6	141.1	7.1
31	17	154.4	8.4	152.6	8.7
32	14	151.9	7.1	149.3	7.5
33	18	140.0	7.2	140.1	7.1
34	15	146.1	8.0	144.3	7.9
35	13	147.9	7.1	149.4	7.9
36	17	149.9	10.2	149.0	9.6
37	18	151.8	7.8	153.6	7.3
38	15	150.0	8.7	148.8	8.3
39	15	135.1	10.6	138.2	9.4
40	13	145.7	7.4	146.7	6.8

Table No. 13

This table shows sodium and potassium values in left eye vitreous sample 1 and left knee synovial fluid sample 1 with time since death more than 24 hours.

S.No	Time of Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	31	148.1	6.9	149.1	6.8
2	27	140.1	10.0	142.2	10.4
3	48	133.1	13.0	134.9	11.8
4	102	126.0	14.9	127.2	14.9
5	29	143.1	8.3	142.5	9.2
6	36	133.2	14.3	132.8	12.7
7	28	139.2	7.1	137.6	7.0

Table No.14

Descriptive for Left side Sample I TSD										
	P value		**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Min**	**Max**
							Lower Bound	**Upper Bound**		
Sample I Lt Eye Na	P<0.001	<12 hrs	31	142.0935	9.18633	1.64991	138.7240	145.4631	126.30	158.00
		12-24 hrs	57	141.8316	9.26536	1.22723	139.3731	144.2900	124.80	159.00
		>24 hrs	12	141.2750	8.20179	2.36765	136.0638	146.4862	126.00	151.80
		Total	100	141.8460	9.03689	.90369	140.0529	143.6391	124.80	159.00
Sample I Lt Eye K	P<0.001	<12 hrs	31	7.9323	3.21894	.57814	6.7515	9.1130	3.10	18.70
		12-24 hrs	57	7.4649	2.30732	.30561	6.8527	8.0771	3.20	14.90
		>24 hrs	12	9.9333	2.79686	.80738	8.1563	11.7104	6.90	14.90
		Total	100	7.9060	2.76240	.27624	7.3579	8.4541	3.10	18.70
Sample I Lt knee Na	P<0.001	<12 hrs	31	141.7742	8.60229	1.54502	138.6188	144.9295	126.80	154.20
		12-24 hrs	57	141.0211	8.67191	1.14862	138.7201	143.3220	124.50	156.80
		>24 hrs	12	141.8833	7.92187	2.28685	136.8500	146.9167	127.20	153.60
		Total	100	141.3580	8.49050	.84905	139.6733	143.0427	124.50	156.80
Sample I Lt Knee K	P<0.001	<12 hrs	31	7.4258	3.04718	.54729	6.3081	8.5435	3.00	18.50
		12-24 hrs	57	6.9895	1.95491	.25893	6.4708	7.5082	3.10	12.10
		>24 hrs	12	9.5167	2.57111	.74222	7.8831	11.1503	6.80	14.90
		Total	100	7.4280	2.51982	.25198	6.9280	7.9280	3.00	18.50

Table No. 15 : Regression for Left K Vitreous Fluid Sample 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.421[a]	.177	.169	.57109
a. Predictors: (Constant), Left K Vitreous humour				

Table No. 16

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.781	.175		4.463	.000
	Left K Vitreous humour	.096	.021	.421	4.592	.000
a. Dependent Variable: TIME SINCE DEATH						

Fig.6.Correlation of sample I of left vitreous potassium with time since death

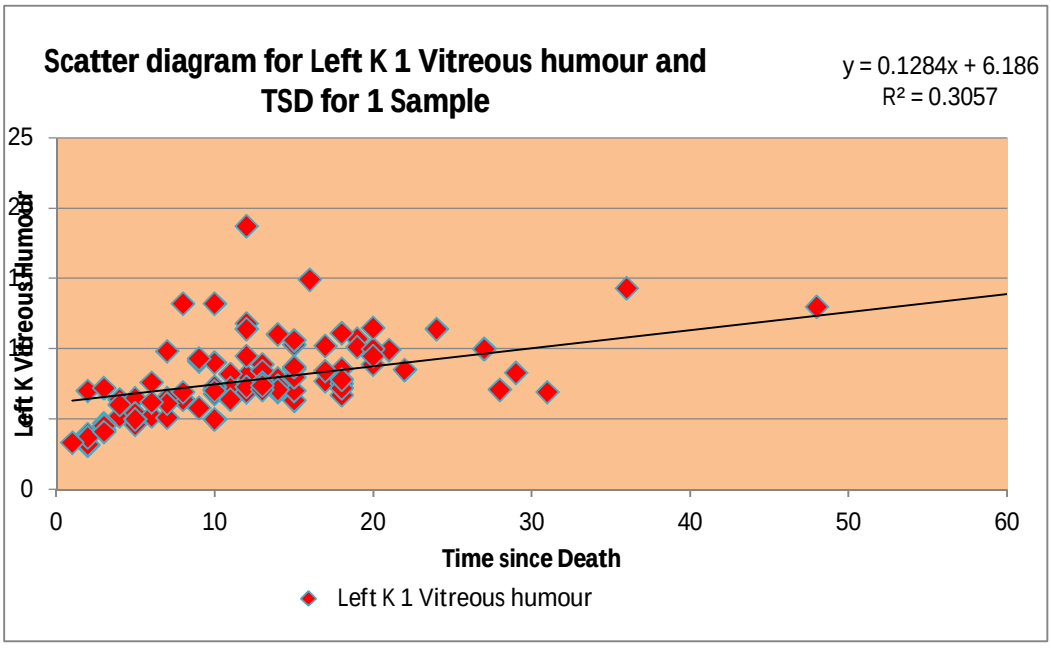


Table No. 17 : Regression for Left K Synovial Fluid Sample 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570[a]	.324	.317	9.78362
a. Predictors: (Constant), Left K Synovial Fluid 1				

Table No. 18

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-6.790	3.098		-2.192	.031
	Left K Synovial Fluid 1	2.698	.393	.570	6.859	.000
a. Dependent Variable: Left TSD 1						

Fig.7. Correlation of sample I of left synovial potassium with time since death

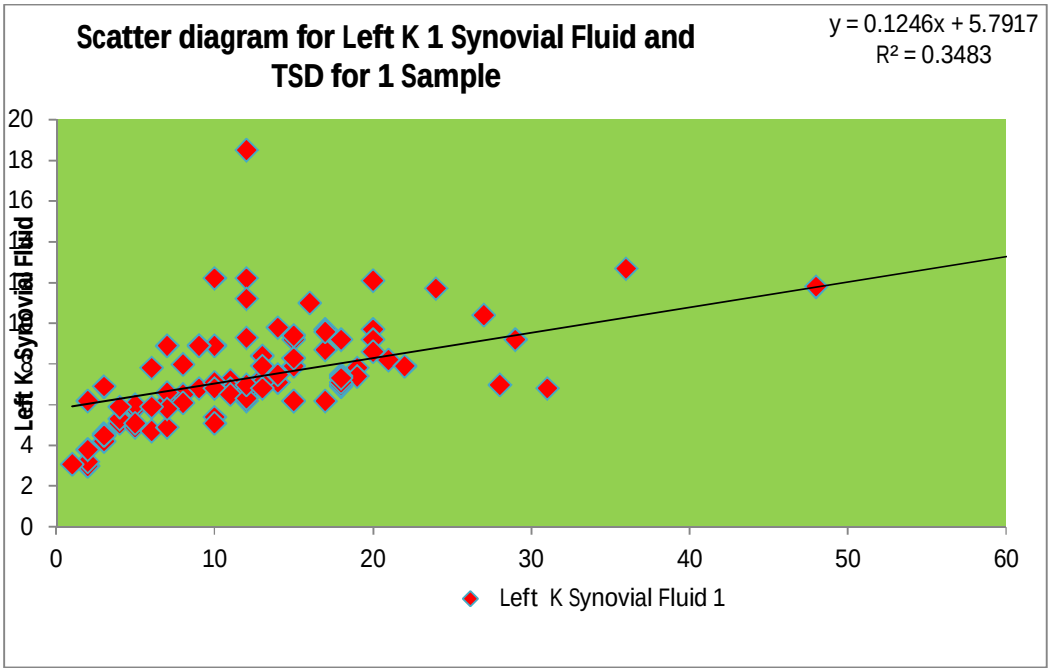


Table No. 19 : Correlation between TSD and Left side Values for sample 1

		Left Na 1 Vitreous humour	Left K 1 Vitreous humour	Left Na Synovial Fluid 1	Left K Synovial Fluid 1
TSD	Pearson Correlation	.004	.536**	.012	.570**
	P Value)	.969	.000	.906	.000
	N	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table No. 20 : T-Test for 0 to 12 hrs for sample 1

Group Statistics						
	P Value	side	N	Mean	Std. Deviation	Std. Error Mean
Na 1 Vitreous humour	p>0.05	Left	53	139.7415	9.38445	1.28905
		Right	53	139.6623	9.51061	1.30638
K 1 Vitreous humour	p>0.05	Left	53	6.9245	2.85986	.39283
		Right	53	6.9415	2.85727	.39248
Na 1 Synovial Fluid	p>0.05	Left	53	139.4509	8.58576	1.17934
		Right	53	139.2075	8.16444	1.12147
K 1 Synovial Fluid	p>0.05	Left	53	6.5755	2.64996	.36400
		Right	53	6.5340	2.61482	.35917

Table No. 21 : T-Test for 12-24 hrs sample 1

Group Statistics						
	P Value	side	N	Mean	Std. Deviation	Std. Error Mean
Na 1 Vitreous humour	p>0.05	Left	40	145.3875	7.70588	1.21841
		Right	40	145.2725	7.76732	1.22812
K 1 Vitreous humour	p>0.05	Left	40	8.7575	1.75921	.27816
		Right	40	8.9075	1.76394	.27890
Na 1 Synovial Fluid	p>0.05	Left	40	144.4200	7.71832	1.22037
		Right	40	144.2100	7.72295	1.22111
K 1 Synovial Fluid	p>0.05	Left	40	8.1500	1.42397	.22515
		Right	40	8.1675	1.50305	.23765

Table No. 22 : T-Test for Above 24 hrs sample 1

Group Statistics						
	P Value	side	N	Mean	Std. Deviation	Std. Error Mean
Na 1 Vitreous humour	p>0.05	Left	7	137.5429	7.34231	2.77513
		Right	7	137.3571	7.32481	2.76852
K 1 Vitreous humour	p>0.05	Left	7	10.6429	3.40385	1.28653
		Right	7	11.1143	3.74941	1.41714
Na 1 Synovial Fluid 1	p>0.05	Left	7	138.0429	7.24036	2.73660
		Right	7	136.6286	7.22812	2.73197
K 1 Synovial Fluid 1	p>0.05	Left	7	10.4000	2.98496	1.12821
		Right	7	10.8429	3.29184	1.24420

Table No. 23

This table shows percentage of cases depending upon time since death in Sample 2 of vitreous humour of both eyes and synovial fluid of both knees.

S. No	TSD (hrs)	No. of Cases	% of cases
1.	Within 12 hours	31	31%
2.	12.1-24 hours	57	57%
3.	Above 24 hours	12	12%
	Total	100	100%

From table no.2, it was concluded that there were 31 cases with time since death within 12 hours which constituted 31 %, 57 cases with time since death from 12.1 hours to 24 hours which constituted 57 % and 12 cases with time since death above 24 hours which constituted 12 % out of 100 total cases.

Table No. 24

This table shows sodium and potassium values in right eye vitreous sample 2 and right knee synovial fluid sample 2 with time since death within 12 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	12	133.3	9.4	134.7	6.1
2	6	144.1	7.1	143.1	7.0
3	12	144.6	8.7	147.4	7.1
4	12	151.2	9.3	150.0	10.2
5	10	154.3	6.1	152.3	7.0
6	4	144.9	7.4	150.7	5.5

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
7	6	149.5	8.6	144.	7.7
8	12	136.3	9.8	127.1	9.8
9	10	136.3	9.8	137.8	10.2
10	12	136.2	14.7	143.1	9.4
11	9	138.7	7.0	142.2	6.6
12	11	145.1	4.9	146.2	5.7
13	12	156.7	9.3	145.6	9.1
14	11	145.2	9.4	144.1	9.4
15	7	130.6	6.2	132.4	5.9
16	7	145.6	6.9	146.1	6.8
17	9	135.6	7.1	136.6	7.0
18	7	132.4	6.0	131.9	5.9
19	11	140.4	8.2	137.8	7.8
20	8	138.9	9.1	139.1	9.0
21	7	136.0	7.7	138.0	7.6
22	6	132.4	5.5	132.7	5.3
23	9	134.7	6.5	135.6	6.3
24	8	130.7	6.5	132.4	6.1
25	11	152.8	7.2	151.7	7.0
26	6	135.5	7.2	136.3	6.5
27	6	135.6	5.4	136.4	5.4
28	9	139.2	8.7	138.7	8.2
29	11	135.4	8.0	135.6	7.4
30	12	147.8	6.9	152.0	7.2
31	10	141.6	6.7	141.6	7.6

Table No. 25

This table shows sodium and potassium values in right eye vitreous sample 2 and right knee synovial fluid sample 2 with time since death from 12.1 to 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	18	141.8	15.5	151.1	11.2
2	15	144.6	8.7	147.4	7.1
3	19	158.4	7.8	156.2	8.0
4	22	150.8	13.6	146.1	11.5
5	13	151.2	9.3	150.0	10.2
6	15	154.3	9.0	151.8	7.9
7	15	151.3	9.3	151.3	8.8
8	20	141.9	11.0	136.5	8.1
9	17	144.6	10.9	138.2	10.0
10	21	140.9	9.9	140.2	8.2
11	15	150.8	8.4	145.0	8.1
12	22	141.3	8.9	135.9	10.2
13	19	150.5	11.8	144.6	11.0
14	18	154.1	7.6	151.3	5.5
15	24	145.5	11.7	137.4	8.7
16	21	151.8	8.0	150.8	7.9
17	15	156.7	10.3	145.6	11.8
18	16	148.2	9.0	151.6	8.1
19	20	142.9	12.0	140.3	9.8
20	13	158.3	13.0	148.7	12.9
21	22	147.3	10.3	151.6	10.8
22	15	144.2	13.2	139.0	12.3
23	20	133.9	8.5	129.3	6.8
24	17	148.6	6.8	143.5	6.3
25	13	165.8	14.1	156.7	12.4
26	18	136.8	8.3	132.8	6.2
27	13	152.0	19.1	151.3	18.8

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
28	23	128.5	9.2	125.6	8.2
29	22	156.8	11.1	152.0	10.4
30	19	146.7	9.4	146.4	9.2
31	21	145.4	10.0	143.5	9.8
32	23	133.2	10.4	130.2	9.8
33	14	136.5	9.6	138.1	10.0
34	15	146.9	8.5	145.6	8.2
35	24	143.2	9.2	142.8	8.9
36	16	146.3	9.3	146.0	8.9
37	15	145.2	8.7	143.5	8.2
38	15	143.5	8.7	142.0	7.9
39	13	136.7	7.8	135.6	7.4
40	21	140.4	11.0	141.2	10.5
41	14	138.9	8.4	140.3	7.7
42	14	136.4	8.2	137.8	7.9
43	24	145.6	12.4	148.3	12.8
44	14	142.3	8.2	141.6	8.2
45	15	150.2	7.4	149.7	6.9
46	19	153.8	9.4	153.4	9.7
47	24	141.2	9.2	144.3	8.9
48	17	147.8	8.9	148.0	9.6
49	17	151.2	8.3	149.2	8.7
50	14	147.7	8.9	142.7	8.2
51	18	147.8	9.8	142.3	9.2
52	19	144.3	10.2	146.7	10.7
53	20	151.3	11.3	152.3	10.2
54	21	151.8	8.0	150.8	7.9
55	20	152.3	10.2	148.8	9.6
56	21	136.7	11.2	141.2	10.8
57	16	143.7	8.6	144.2	8.0

Table No. 26

This table shows sodium and potassium values in right eye vitreous sample 2 and right knee synovial fluid sample 2 with time since death more than 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	29	141.2	13.2	139.0	12.3
2	33	147.5	7.9	146.6	7.6
3	29	148.7	11.3	148.1	10.5
4	53	128.4	14.6	129.0	14.3
5	103	126.8	17.5	123.8	16.2
6	32	141.5	8.9	138.4	12.0
7	38	139.5	18.1	142.6	16.1
8	32	136.5	8.0	134.0	7.4
9	62	134.8	14.9	135.2	14.3
10	45	149.4	14.9	144.2	15.0
11	50	135.8	14.6	138.8	13.7
12	25	145.6	10.8	144.3	10.7

Table No. 27

Descriptive for Right side Sample II TSD										
	P value		**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Min**	**Max**
							Lower Bound	**Upper Bound**		
Sample 2 R Eye Na	P<0.001	<12 hrs	31	140.6968	7.21722	1.29625	138.0495	143.3441	130.60	156.70
		12-24 hrs	57	146.3298	7.04151	.93267	144.4615	148.1982	128.50	165.80
		>24 hrs	12	139.6417	7.50630	2.16688	134.8724	144.4109	126.80	149.40
		Total	100	143.7810	7.67383	.76738	142.2583	145.3037	126.80	165.80
Sample 2 R Eye K	P<0.001	<12 hrs	31	7.7839	1.88186	.33799	7.0936	8.4741	4.90	14.70
		12-24 hrs	57	9.9561	2.17420	.28798	9.3792	10.5330	6.80	19.10
		>24 hrs	12	12.8917	3.49089	1.00773	10.6737	15.1097	7.90	18.10
		Total	100	9.6350	2.74209	.27421	9.0909	10.1791	4.90	19.10
Sample 2 R knee Na	P<0.001	<12 hrs	31	140.7484	6.76397	1.21484	138.2673	143.2294	127.10	152.30
		12-24 hrs	57	144.5316	6.71034	.88881	142.7511	146.3121	125.60	156.70
		>24 hrs	12	138.6667	7.25012	2.09293	134.0602	143.2732	123.80	148.10
		Total	100	142.6550	7.09008	.70901	141.2482	144.0618	123.80	156.70
Sample 2 R Knee K	P<0.001	<12 hrs	31	7.3484	1.44173	.25894	6.8196	7.8772	5.30	10.20
		12-24 hrs	57	9.3158	2.10253	.27849	8.7579	9.8737	5.50	18.80
		>24 hrs	12	12.5083	2.99043	.86326	10.6083	14.4084	7.40	16.20
		Total	100	9.0890	2.55335	.25533	8.5824	9.5956	5.30	18.80

Table No. 28 : Regression for Right K Vitreous Fluid Sample 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.574[a]	.330	.323	.51913
a. Predictors: (Constant), Right K Vitreous humour				

Table No. 29

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.548	.189		2.899	.005
	Right K Vitreous humour	.131	.019	.574	6.940	.000
a. Dependent Variable: TIME SINCE DEATH						

Fig.8. Correlation of sample 2 of right vitreous potassium with time since death

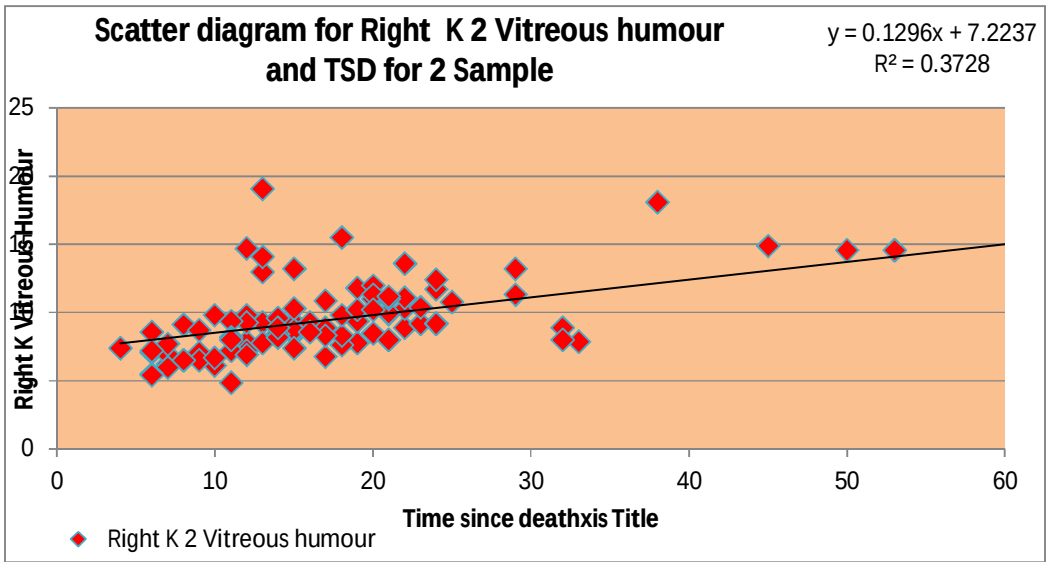


Table No. 30 : Regression Right K Synovial Fluid 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.629[a]	.396	.390	10.14164
a. Predictors: (Constant), Right K Synovial Fluid 2				

Table No. 31

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-10.614	3.755		-2.826	.006
	Right K Synovial Fluid 2	3.199	.399	.629	8.019	.000
a. Dependent Variable: Left TSD 2						

Fig.9.Correlation of sample 2 of right synovial potassium with time since death

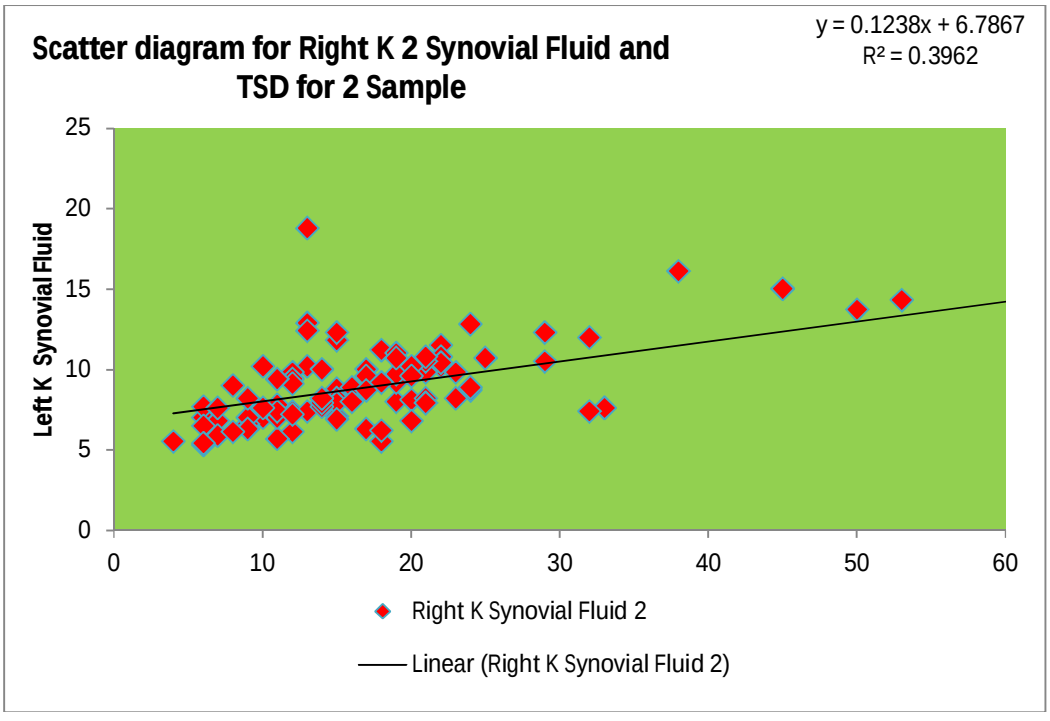


Table No. 32

Correlation between TSD and Right side Values for sample2

		Right Na 2 Vitreous humour	Right K 2 Vitreous humour	Right Na Synovial Fluid 2	Right K Synovial Fluid 2
Left TSD 2	Pearson Correlation	-.195	.611**	-.231*	.629**
	Sig. (2-tailed)	.052	.000	.021	.000
	N	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table No. 33

This table shows sodium and potassium values in left eye vitreous sample 2 and left knee synovial fluid sample 2 with time since death within 12 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	12	132.9	9.1	134.4	6.1
2	6	144.5	7.5	144.3	6.9
3	12	145.1	7.7	140.8	7.1
4	12	149.0	7.1	138.2	6.9
5	10	153.9	6.1	149.7	7.4
6	4	145.1	7.5	147.9	5.8
7	6	150.2	7.9	147.4	7.5
8	12	136.5	9.7	130.2	9.6

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
9	10	136.1	10.4	135.3	9.8
10	12	136.0	13.9	145.5	9.2
11	9	139.0	6.6	143.4	6.6
12	11	144.9	5.2	143.2	5.3
13	12	156.4	9.5	154.5	9.1
14	11	144.8	9.6	145.6	9.2
15	7	131.1	6.1	135.6	6.0
16	7	144.8	6.7	143.6	6.8
17	9	136.0	7.3	137.0	6.9
18	7	132.0	5.9	132.0	6.0
19	11	145.6	7.9	141.2	7.8
20	8	139.2	8.9	140.0	9.0
21	7	135.6	7.6	133.4	7.3
22	6	131.8	5.4	132.6	5.6
23	9	134.5	6.4	135.3	6.2
24	8	131.0	6.3	132.1	6.0
25	11	153.8	7.4	152.0	7.2
26	6	133.5	7.0	135.3	6.3
27	6	135.7	5.3	135.3	5.6
28	9	140.1	8.6	138.4	8.0
29	11	134.8	7.7	135.6	7.6
30	12	148.1	6.9	152.2	7.1
31	10	141.8	6.8	141.7	7.5

Table No.34

This table shows sodium and potassium values in left eye vitreous sample 2 and left knee synovial fluid sample 2 with time since death from 12.1 hours to 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	18	142.0	15.8	150.8	11.4
2	15	144.4	8.5	147.5	6.9
3	19	158.5	7.8	156.2	8.1
4	22	150.6	12.8	144.6	10.9
5	13	151.0	8.5	150.0	10.0
6	15	154.1	9.0	152.2	7.8
7	15	151.2	8.9	150.3	8.9
8	20	142.0	10.3	136.7	7.8
9	17	145.1	10.7	139.8	9.5
10	21	141.2	9.5	138.6	7.8
11	15	151.4	8.5	151.7	8.2
12	22	141.0	8.8	137.8	9.9
13	19	150.9	12.1	145.6	10.7
14	18	154.2	7.9	150.9	6.5
15	24	144.9	11.5	142.6	8.9
16	21	152.0	8.3	151.5	8.1
17	15	156.9	9.9	146.3	11.2
18	16	148.6	8.9	152.3	8.6
19	20	143.2	11.9	138.0	9.9
20	13	158.0	13.4	147.8	12.7
21	22	148.0	9.8	147.4	10.9
22	15	144.1	11.8	145.0	11.7
23	20	134.0	8.2	135.5	7.4
24	17	149.3	6.8	148.8	6.7
25	13	165.3	13.6	159.5	12.8
26	18	136.7	7.6	135.2	6.4
27	13	152.0	18.9	152.0	19.2

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
28	23	128.3	8.6	127.6	8.5
29	22	156.6	10.5	157.2	9.5
30	19	146.5	9.4	145.9	9.0
31	21	145.6	10.4	144.3	9.6
32	23	135.2	10.3	131.8	9.7
33	14	136.2	9.5	139.0	9.6
34	15	147.0	8.4	146.0	7.4
35	24	146.0	8.8	146.3	8.7
36	16	146.1	9.2	145.9	9.0
37	15	145.0	8.5	143.2	8.2
38	15	143.4	8.7	141.9	8.0
39	13	137.0	7.6	136.2	7.4
40	21	141.1	10.7	141.0	11.0
41	14	139.0	9.0	144.2	8.2
42	14	137.7	8.0	137.6	8.1
43	24	146.0	12.5	148.0	12.8
44	14	141.8	8.1	142.0	8.2
45	15	148.9	7.3	150.0	6.7
46	19	152.8	9.2	154.4	8.9
47	24	144.2	8.8	144.3	8.7
48	17	147.2	8.7	148.4	9.2
49	17	152.2	8.3	149.2	8.6
50	14	146.7	8.7	141.9	8.0
51	18	149.1	10.0	145.1	9.4
52	19	143.8	10.3	144.7	10.4
53	20	150.3	10.8	152.2	10.1
54	21	152.8	8.2	150.5	7.6
55	20	152.3	10.3	149.4	9.2
56	21	136.3	11.4	142.2	10.5
57	16	144.1	8.8	147.2	8.3

Table No. 35

This table shows sodium and potassium values in left eye vitreous sample 2 and left knee synovial fluid sample 2 with time since death more than 24 hours.

S.No	Time since Death	Vitreous		Synovial	
		Sodium	Potassium	Sodium	Potassium
1	29	141.1	12.8	138.6	11.9
2	33	147.8	7.8	147.2	7.4
3	29	148.3	11.5	150.3	10.9
4	53	135.6	13.8	134.0	13.7
5	103	126.3	15.8	128.2	15.6
6	32	140.8	8.8	141.0	11.6
7	38	140.2	17.7	138.3	14.9
8	32	136.7	7.5	138.2	7.4
9	62	135.0	14.7	134.8	13.9
10	45	149.2	14.6	143.9	14.2
11	50	135.8	14.7	140.4	13.8
12	25	145.9	10.6	145.3	10.5

Table No. 36

Descriptive for Left side Sample II TSD										
	P value		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
							Lower Bound	Upper Bound		
Sample 2 L Eye Na	P<0.001	<12 hrs	31	140.7677	7.30823	1.31260	138.0871	143.4484	131.00	156.40
		12-24 hrs	57	146.4877	6.89241	.91292	144.6589	148.3165	128.30	165.30
		>24 hrs	12	140.2250	6.81604	1.96762	135.8943	144.5557	126.30	149.20
		Total	100	143.9630	7.53521	.75352	142.4679	145.4581	126.30	165.30
Sample2 L Eye K	P<0.001	<12 hrs	31	7.6129	1.77759	.31926	6.9609	8.2649	5.20	13.90
		12-24 hrs	57	9.8018	2.13897	.28331	9.2342	10.3693	6.80	18.90
		>24 hrs	12	12.5250	3.29162	.95021	10.4336	14.6164	7.50	17.70
		Total	100	9.4500	2.65020	.26502	8.9241	9.9759	5.20	18.90
Sample 2 L knee Na	P<0.001	<12 hrs	31	140.4419	6.63861	1.19233	138.0069	142.8770	130.20	154.50
		12-24 hrs	57	145.4772	6.35978	.84237	143.7897	147.1647	127.60	159.50
		>24 hrs	12	140.0167	6.12563	1.76832	136.1246	143.9087	128.20	150.30
		Total	100	143.2610	6.85531	.68553	141.9008	144.6212	127.60	159.50
Sample 2 L Knee K	P<0.001	<12 hrs	31	7.2065	1.25961	.22623	6.7444	7.6685	5.30	9.80
		12-24 hrs	57	9.2526	2.04931	.27144	8.7089	9.7964	6.40	19.20
		>24 hrs	12	12.1500	2.72413	.78639	10.4192	13.8808	7.40	15.60
		Total	100	8.9660	2.43444	.24344	8.4830	9.4490	5.30	19.20

Table No. 37
Regression for Left K Vitreous Fluid Sample 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.567[a]	.322	.315	.52219
a. Predictors: (Constant), Left K Vitreous humour				

Table No. 38

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.535	.194		2.751	.007
	Left K Vitreous humour	.135	.020	.567	6.816	.000
a. Dependent Variable: TIME SINCE DEATH						

Fig.10. Correlation of sample 2 of left vitreous potassium with time since death

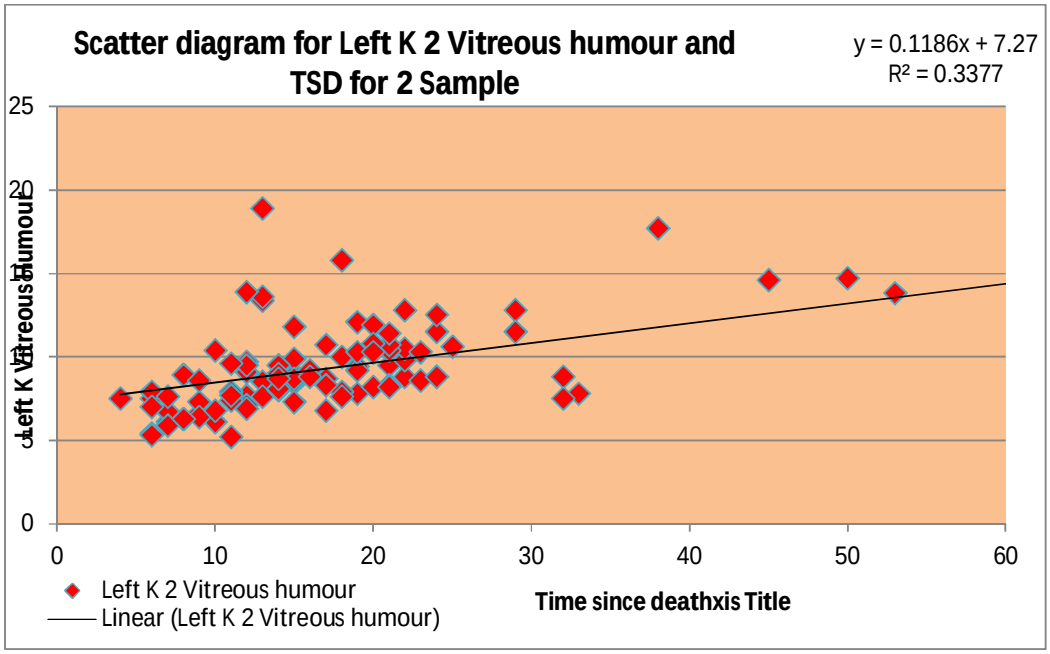


Table No. 39 : Regression Left K Synovial Fluid Sample 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.618[a]	.382	.376	10.30944
a. Predictors: (Constant), Left K Synovial Fluid 2				

Table No. 40

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-11.243	3.959		-2.840	.005
	Left K Synovial Fluid 2	3.309	.427	.618	7.746	.000
a. Dependent Variable: Left TSD 2						

Fig.11. Correlation of sample 2 of left synovial potassium with time since death

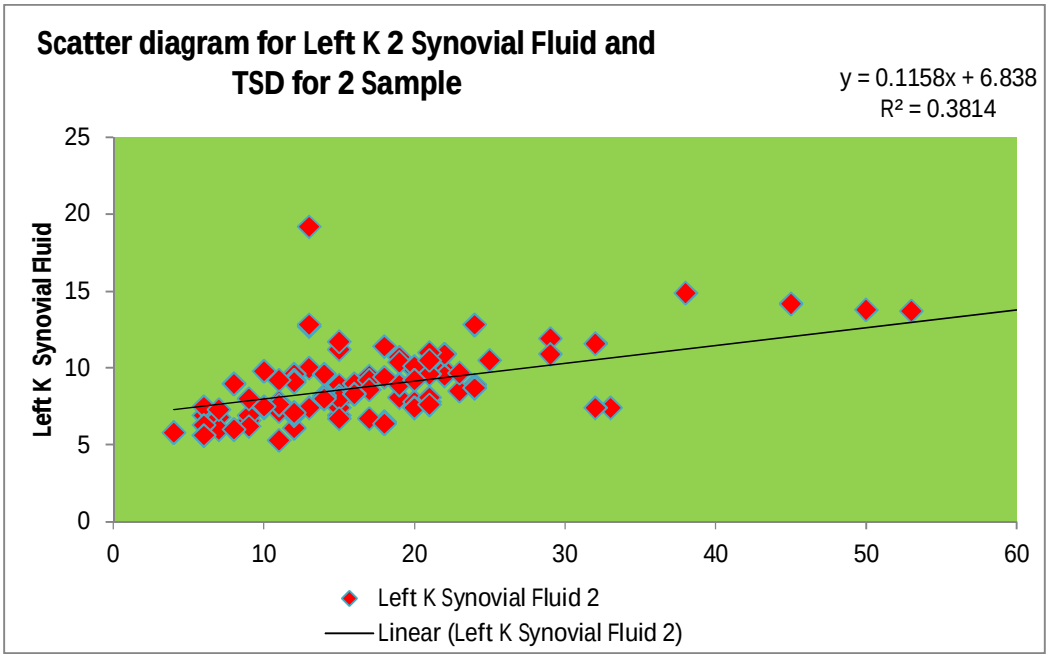


Table No.41

Correlation between TSD and Left side Values for sample 2

		Left Na 2 Vitreous humour	**Left K 2 Vitreous humour**	**Left Na Synovial Fluid 2**	**Left K Synovial Fluid 2**
TSD	Pearson Correlation	-.173	.581**	-.173	.618**
	P Value	.088	.000	.085	.000
	N	99	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table No. 42 : T-Test for 0-12 hrs sample 2

Group Statistics						
	P Value	Side	N	Mean	Std. Deviation	Std ErrorMean
Na 2 Vitreous humour	p>0.05	Left	31	140.7677	7.30823	1.31260
		Right	31	140.6097	7.09983	1.27517
K 2 Vitreous humour	p>0.05	Left	31	7.6129	1.77759	.31926
		Right	31	7.6903	1.85461	.33310
Na 2 Synovial Fluid	p>0.05	Left	31	140.4419	6.63861	1.19233
		Right	31	140.1677	6.43803	1.15630
K 2 Synovial Fluid	p>0.05	Left	31	7.2065	1.25961	.22623
		Right	31	7.2645	1.34103	.24086

Table No. 43 : T-Test for 12-24 hrs sample 2

Group Statistics						
	P Value	side	N	Mean	Std. Deviation	Std. Error Mean
Na 2 Vitreous humour	p>0.05	Left	57	146.4877	6.89241	.91292
		Right	57	146.3298	7.04151	.93267
K 2 Vitreous humour	p>0.05	Left	57	9.8018	2.13897	.28331
		Right	57	9.9561	2.17420	.28798
Na 2 Synovial Fluid	p>0.05	Left	57	145.4772	6.35978	.84237
		Right	57	144.5316	6.71034	.88881
K 2 Synovial Fluid	p>0.05	Left	57	9.2526	2.04931	.27144
		Right	57	9.3158	2.10253	.27849

Table No. 44 : T-Test for Above 24 hrs sample 2

Group Statistics						
	P Value	side	N	Mean	Std. Deviation	Std. Error Mean
Na 2 Vitreous humour	p>0.05	Left	12	140.2250	6.81604	1.96762
		Right	12	139.6417	7.50630	2.16688
K 2 Vitreous humour	p>0.05	Left	12	12.5250	3.29162	.95021
		Right	12	12.8917	3.49089	1.00773
Na 2 Synovial Fluid	p>0.05	Left	12	140.0167	6.12563	1.76832
		Right	12	138.6667	7.25012	2.09293
K 2 Synovial Fluid	p>0.05	Left	12	12.1500	2.72413	.78639
		Right	12	12.5083	2.99043	.86326

Table No. 45

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
sample I Eye Vitreous Sodium	Right	100	141.7450	9.12358	.91236
	Left	100	141.8460	9.03689	.90369
sample I Eye Vitreous Potassium	Right	100	8.0250	2.82311	.28231
	Left	100	7.9060	2.76240	.27624
sample I Knee Synovial Sodium	Right	100	141.0280	8.30111	.83011
	Left	100	139.9810	15.14317	1.51432
sample I Knee Synovial Potassium	Right	100	7.4860	2.57105	.25711
	Left	100	7.4280	2.51982	.25198
sample II Eye Vitreous Sodium	Right	100	143.7810	7.67383	.76738
	Left	100	143.9630	7.53521	.75352
sample II Eye Vitreous Potassium	Right	100	9.6350	2.74209	.27421
	Left	100	9.4500	2.65020	.26502
sample II Knee Synovial Sodium	Right	100	142.6550	7.09008	.70901
	Left	100	143.2610	6.85531	.68553
sample II Knee Synovial Potassium	Right	100	9.0890	2.55335	.25533
	Left	100	8.9660	2.43444	.24344

P>0.05 no difference among left and right values

Table No. 46 : T-Test for Timing 0-12 hrs

Group Statistics						
	P value	Group	N	Mean	Std. Deviation	Std. Error Mean
Left Na Vitreous humour	p>0.05	Sample 1	53	139.7415	9.38445	1.28905
		Sample 2	31	140.7677	7.30823	1.31260
Left K Vitreous humour	p>0.05	Sample 1	53	6.9245	2.85986	.39283
		Sample 2	31	7.6129	1.77759	.31926
Left Na Synovial Fluid	p>0.05	Sample 1	53	139.4509	8.58576	1.17934
		Sample 2	31	140.4419	6.63861	1.19233
Left K Synovial Fluid	p>0.05	Sample 1	53	6.5755	2.64996	.36400
		Sample 2	31	7.2065	1.25961	.22623
Right Na Vitreous humour	p>0.05	Sample 1	53	139.6623	9.51061	1.30638
		Sample 2	31	140.6097	7.09983	1.27517
Right K Vitreous humour	p>0.05	Sample 1	53	6.9415	2.85727	.39248
		Sample 2	31	7.6903	1.85461	.33310
Right Na Synovial Fluid	p>0.05	Sample 1	53	139.2075	8.16444	1.12147
		Sample 2	31	140.1677	6.43803	1.15630
Right K Synovial Fluid	p>0.05	Sample 1	53	6.5340	2.61482	.35917
		Sample 2	31	7.2645	1.34103	.24086

Table No. 47 : T-Test for 12-24 hrs

Group Statistics						
	P Value	Group	N	Mean	Std. Deviation	Std. Error Mean
Left Na Vitreous humour	p>0.05	Sample 1	40	145.3875	7.70588	1.21841
		Sample 2	57	146.4877	6.89241	.91292
Left K Vitreous humour	P<0.05*	Sample 1	40	8.7575	1.75921	.27816
		Sample 2	57	9.8018	2.13897	.28331
Left Na Synovial Fluid	p>0.05	Sample 1	40	144.4200	7.71832	1.22037
		Sample 2	57	145.4772	6.35978	.84237
Left K Synovial Fluid	P<0.05*	Sample 1	40	8.1500	1.42397	.22515
		Sample 2	57	9.2526	2.04931	.27144
Right Na Vitreous humour	p>0.05	Sample 1	40	145.2725	7.76732	1.22812
		Sample 2	57	146.3298	7.04151	.93267
Right K Vitreous humour	P<0.05*	Sample 1	40	8.9075	1.76394	.27890
		Sample 2	57	9.9561	2.17420	.28798
Right Na Synovial Fluid	p>0.05	Sample 1	40	144.2100	7.72295	1.22111
		Sample 2	57	144.5316	6.71034	.88881
Right K Synovial Fluid	P<0.05*	Sample 1	40	8.1675	1.50305	.23765
		Sample 2	57	9.3158	2.10253	.27849

Table No.48 : T-Test for Above 24 hrs

Group Statistics						
	P value	Group	N	Mean	Std. Deviation	Std. Error Mean
Left Na Vitreous humour	p>0.05	Sample 1	7	137.5429	7.34231	2.77513
		Sample 2	12	140.2250	6.81604	1.96762
Left K Vitreous humour	p>0.05	Sample 1	7	10.6429	3.40385	1.28653
		Sample 2	12	12.5250	3.29162	.95021
Left Na Synovial Fluid	p>0.05	Sample 1	7	138.0429	7.24036	2.73660
		Sample 2	12	140.0167	6.12563	1.76832
Left K Synovial Fluid	p>0.05	Sample 1	7	10.4000	2.98496	1.12821
		Sample 2	12	12.1500	2.72413	.78639
Right Na Vitreous humour	p>0.05	Sample 1	7	137.3571	7.32481	2.76852
		Sample 2	12	139.6417	7.50630	2.16688
Right K Vitreous humour	p>0.05	Sample 1	7	11.1143	3.74941	1.41714
		Sample 2	12	12.8917	3.49089	1.00773
Right Na Synovial Fluid	p>0.05	Sample 1	7	136.6286	7.22812	2.73197
		Sample 2	12	138.6667	7.25012	2.09293
Right K Synovial Fluid	p>0.05	Sample 1	7	10.8429	3.29184	1.24420
		Sample 2	12	12.5083	2.99043	.86326

Table No. 49 :One way ANOVA for Comparing Left and Right Na and K values for Three periods (0 to 12, 12 to 24 and Above 24 hrs Sample 1

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max	
						Lower Bound	Upper Bound			
Left Na 1 Vitreous humour	0-12 hrs	53	139.74	9.38	1.29	137.15	142.33	126.30	158.00	p<0.001
	12-24 hrs	40	145.39	7.71	1.22	142.92	147.85	124.80	159.00	
	Above 24 hrs	7	137.54	7.34	2.78	130.75	144.33	126.00	148.10	
	Total	100	141.85	9.04	.90	140.05	143.64	124.80	159.00	
Left K 1 Vitreous humour	0-12 hrs	53	6.92	2.86	.39	6.14	7.71	3.10	18.70	p<0.001
	12-24 hrs	40	8.76	1.76	.28	8.19	9.32	6.30	14.90	
	Above 24 hrs	7	10.64	3.40	1.29	7.49	13.79	6.90	14.90	
	Total	100	7.92	2.75	.27	7.37	8.46	3.10	18.70	

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max	
						Lower Bound	Upper Bound			
Left Na 1 Synovial Fluid	0-12 hrs	53	139.45	8.59	1.18	137.08	141.82	126.50	154.20	p<0.001
	12-24 hrs	40	144.42	7.72	1.22	141.95	146.89	124.50	156.80	
	Above 24 hrs	7	138.04	7.24	2.74	131.35	144.74	127.20	149.10	
	Total	100	141.34	8.48	.85	139.66	143.02	124.50	156.80	
Left K 1 Synovial Fluid	0-12 hrs	53	6.58	2.65	.36	5.85	7.31	3.00	18.50	p<0.001
	12-24 hrs	40	8.15	1.42	.23	7.69	8.61	6.20	12.10	
	Above 24 hrs	7	10.40	2.98	1.13	7.64	13.16	6.80	14.90	
	Total	100	7.47	2.50	.25	6.98	7.97	3.00	18.50	
Right Na1 Vitreous humour	0-12 hrs	53	139.66	9.51	1.31	137.04	142.28	126.50	157.90	p<0.001
	12-24 hrs	40	145.27	7.77	1.23	142.79	147.76	125.10	158.70	
	Above 24 hrs	7	137.36	7.32	2.77	130.58	144.13	125.70	147.90	
	Total	100	141.75	9.12	.91	139.93	143.56	125.10	158.70	

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max	
						Lower Bound	Upper Bound			
Right K 1 Vitreous humour	0-12 hrs	53	6.94	2.86	.39	6.15	7.73	2.90	18.60	p<0.001
	12-24 hrs	40	8.91	1.76	.28	8.34	9.47	5.80	14.60	
	Above 24 hrs	7	11.11	3.75	1.42	7.65	14.58	7.20	16.30	
	Total	100	8.02	2.83	.28	7.46	8.58	2.90	18.60	
Right Na Synovial Fluid 1	0-12 hrs	53	139.21	8.16	1.12	136.96	141.46	126.50	154.80	p<0.001
	12-24 hrs	40	144.21	7.72	1.22	141.74	146.68	123.30	157.00	
	Above 24 hrs	7	136.63	7.23	2.73	129.94	143.31	124.60	148.50	
	Total	100	141.03	8.30	.83	139.38	142.68	123.30	157.00	
Right K Synovial Fluid 1	0-12 hrs	53	6.53	2.61	.36	5.81	7.25	2.80	17.90	p<0.001
	12-24 hrs	40	8.17	1.50	.24	7.69	8.65	5.40	11.90	
	Above 24 hrs	7	10.84	3.29	1.24	7.80	13.89	6.90	15.60	
	Total	100	7.49	2.57	.26	6.98	8.00	2.80	17.90	

Table No. 50 : One way ANOVA for Comparing Left and Right Na and K values for three periods (0 to 12 , 12 to 24 and Above 24 hrs Sample 2)

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max	
						Lower Bound	Upper Bound			
Left Na 2 Vitreous humour	0-12 hrs	31	140.8	7.3	1.3	138.1	143.4	131.0	156.4	p<0.001
	12-24 hrs	56	146.6	6.9	0.9	144.7	148.4	128.3	165.3	
	Above 24 hrs	12	140.2	6.8	2.0	135.9	144.6	126.3	149.2	
	Total	99	144.0	7.6	0.8	142.5	145.5	126.3	165.3	
Left K 2 Vitreous humour	0-12 hrs	31	7.6	1.8	0.3	7.0	8.3	5.2	13.9	p<0.001
	12-24 hrs	57	9.8	2.1	0.3	9.2	10.4	6.8	18.9	
	Above 24 hrs	12	12.5	3.3	1.0	10.4	14.6	7.5	17.7	
	Total	100	9.5	2.7	0.3	8.9	10.0	5.2	18.9	
Left Na 2 Synovial Fluid	0-12 hrs	31	140.4	6.6	1.2	138.0	142.9	130.2	154.5	p<0.001
	12-24 hrs	57	145.5	6.4	0.8	143.8	147.2	127.6	159.5	
	Above 24 hrs	12	140.0	6.1	1.8	136.1	143.9	128.2	150.3	
	Total	100	143.3	6.9	0.7	141.9	144.6	127.6	159.5	
Left K 2 Synovial Fluid	0-12 hrs	31	7.2	1.3	0.2	6.7	7.7	5.3	9.8	p<0.001
	12-24 hrs	57	9.3	2.0	0.3	8.7	9.8	6.4	19.2	
	Above 24 hrs	12	12.2	2.7	0.8	10.4	13.9	7.4	15.6	
	Total	100	9.0	2.4	0.2	8.5	9.4	5.3	19.2	

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max	
						Lower Bound	Upper Bound			
Right Na 2 Vitreous humour	0-12 hrs	31	140.6	7.1	1.3	138.0	143.2	130.6	156.7	p<0.001
	12-24 hrs	57	146.3	7.0	0.9	144.5	148.2	128.5	165.8	
	Above 24 hrs	12	139.6	7.5	2.2	134.9	144.4	126.8	149.4	
	Total	100	143.8	7.7	0.8	142.2	145.3	126.8	165.8	
Right K 2 Vitreous humour	0-12 hrs	31	7.7	1.9	0.3	7.0	8.4	4.9	14.7	p<0.001
	12-24 hrs	57	10.0	2.2	0.3	9.4	10.5	6.8	19.1	
	Above 24 hrs	12	12.9	3.5	1.0	10.7	15.1	7.9	18.1	
	Total	100	9.6	2.8	0.3	9.1	10.2	4.9	19.1	
Right Na 2 Synovial Fluid	0-12 hrs	31	140.2	6.4	1.2	137.8	142.5	127.1	152.3	p<0.001
	12-24 hrs	57	144.5	6.7	0.9	142.8	146.3	125.6	156.7	
	Above 24 hrs	12	138.7	7.3	2.1	134.1	143.3	123.8	148.1	
	Total	100	142.5	7.1	0.7	141.1	143.9	123.8	156.7	
Right K 2 Synovial Fluid	0-12 hrs	31	7.3	1.3	0.2	6.8	7.8	5.3	10.2	p<0.001
	12-24 hrs	57	9.3	2.1	0.3	8.8	9.9	5.5	18.8	
	Above 24 hrs	12	12.5	3.0	0.9	10.6	14.4	7.4	16.2	
	Total	100	9.1	2.6	0.3	8.6	9.6	5.3	18.8	

Discussion

DISCUSSION

The most important tool in medico legal autopsy is estimation of time since death. Though physical changes like cooling of body, eye changes, post-mortem staining, rigor mortis, decomposition, stomach contents, bowel contents, bladder contents and circumstantial evidence help in estimating the time since death, the biochemical changes which occur in an orderly fashion give more accurate result.

In this study both vitreous and synovial sodium and potassium concentration is estimated to determine the time since death and also compares the results of both sides and between synovial fluid and vitreous.

The first sample was taken from both the eyes and both the knee joints at the same time as early as possible after entry of the body into the mortuary whose times of death were known. Samples were tabled as cases with time since death within 12 hours, from 12.1 to 24 hours and above 24 hours.

Table No.1 shows number and percentage of cases which falls within the time intervals. It was concluded that there were 53 cases with time since death within 12 hours which constituted 53%, there were 40 cases with time since death from 12.1 to 24 hours which constituted 40% and 7 cases with time since death more than 24 hours which constituted 7% out of 100 total cases.

Table No.2 shows sodium and potassium values of sample 1 of right vitreous and right synovial fluid of 53 cases whose times since death were within 12 hours. Range of TSD is 1-12 hours.

Table No.3 shows sodium and potassium values of sample 1 of right vitreous and right synovial fluid of 40 cases whose time of death is between 12.1 to 24 hours. Range of TSD is 13- 24 hours.

Table No.4 shows sodium and potassium values of sample I of right vitreous and right synovial fluid of 10 cases with time since death more than 24 hours. Range of TSD is 27-102 hours.

Table No.5 shows total number of cases N, Mean, Standard deviation, standard error, 95% confidence interval for mean and the range of sodium and potassium values of sample I of right eye and right knee. Each group have different values (<12 hours, 12.1-24 hours and >24 hours). The table depicts $p< 0.001$ which is a statistically significant data which concludes the positive correlation of time since death with potassium increase whereas sodium level falls as time increases. Hence it is not statistically significant.

Table No. 6, 7 shows the regression for sample I of right eye vitreous fluid with time since death as a dependent variable. The values of vitreous potassium and time since death were significantly correlated($r=0.450$).

Figure 4 shows the linear correlation between time since death and the increase in potassium in sample I of right vitreous potassium.

Table No.8, 9 shows the regression for sample I of right synovial fluid with time since death as a dependent variable. The values of synovial potassium and time since death were significantly correlated(r=0.603)

Figure 5 shows a linear correlation between time since death and the increase in potassium in sample I of right synovial fluid.

Table No.10 shows the Pearson coefficient of 0.580 of sample I of right vitreous potassium and 0.603 of sample I of right synovial fluid potassium which has a significant correlation with time since death whereas sodium has negative correlation.

Table No. 11 shows the sodium and potassium values of 53 cases of sample I of left eye vitreous and left synovial fluid whose time since death is within 12 hours. Range of TSD is 1-12 hours.

Table No. 12 shows the sodium and potassium values of 40 cases of sample I of left eye vitreous and left synovial fluid whose time since death is between 12.1- 24 hours. Range of TSD is 13-24 hours.

Table No. 13 shows the sodium and potassium values of 7 cases of sample I of right eye vitreous and right synovial fluid whose time since death is more than 24 hours. Range of TSD is 27-102 hours.

Table No. 14 shows total number of cases N, Mean, Standard deviation, standard error, 95% confidence interval for mean and the range of sodium and

potassium values of sample I of left eye and left knee. Each group have different values (<12 hours, 12.1-24 hours and >24 hours). The table depicts as the time increases level of potassium also increases and p< 0.001 which is statistically significant data whereas sodium level falls as time increases. Hence it is not statistically significant.

Table No. 15, 16 shows the regression for sample I of left eye vitreous fluid with time since death as a dependent variable. The value of vitreous potassium and time since death were significantly correlated(r=0.421)

Figure 6 shows a linear correlation between time since death and the increase in potassium in sample I of left vitreous humour.

Table No. 17, 18 shows the regression for sample I of left synovial fluid with time since death as a dependent variable. The value of vitreous potassium and time since death were significantly correlated(r=0.570)

Figure 7 shows a linear correlation between time since death and the increase in potassium in sample I of left synovial fluid.

Table No.19 shows the Pearson coefficient of 0.536 of sample I of left vitreous potassium and 0.570 of sample I of left synovial fluid potassium which has a significant correlation with time since death whereas sodium has negative correlation.

Table No. 20, 21 and 22 show the T-test which compares the sodium and potassium values of sample I of vitreous and synovial fluid on both sides. $p>0.005$ is a non-significant data which concludes there is no difference among the side in respective values.

The second sample was taken from both the eyes and both the knee joints at the same time during post mortem examination. Samples were tabled as cases with time since death within 12 hours, from 12.1 to 24 hours and above 24 hours. Table No.23 shows number and percentage of cases which falls within the time intervals. It was concluded that there were 31 cases with time since death within 12 hours which constituted 31% , there were 57 cases with time since death from 12.1 to 24 hours which constituted 57% and 12 cases with time since death more than 24 hours which constituted 12% out of 100 total cases.

Table No.24 shows sodium and potassium values of sample 2 of right vitreous and right synovial fluid of 31 cases whose time since death is within 12 hours. Range of TSD is 4-12 hours.

Table No.25 shows sodium and potassium values of sample 2 of right vitreous and right synovial fluid of 57 cases whose time of death is between 12.1 to 24 hours. Range of TSD is 13- 24 hours.

Table No.26 shows sodium and potassium values of sample 2 of right vitreous and right synovial fluid of 12 cases with time since death more than 24 hours. Range of TSD is 25-103 hours.

Table No.27 shows total number of cases N, Mean, Standard deviation, standard error, 95% confidence interval for mean and the range of sodium and potassium values of sample 2 of right eye and right knee. Each group have different values (<12 hours, 12.1-24 hours and >24 hours). The table depicts as the time increases level of potassium also increases and $p< 0.001$ which is statistically significant data whereas sodium level falls as time increases. Hence it is not statistically significant.

Table No. 28 and 29 shows the regression for sample 2 of right eye vitreous fluid with time since death as a dependent variable. The value of vitreous potassium and time since death were significantly correlated(r=0.574)

Figure 8 shows a linear correlation between time since death and the increase in potassium in sample 2 of right vitreous humour.

Table No.30, 31 shows the regression for sample 2 of right synovial fluid with time since death as a dependent variable. The value of synovial potassium and time since death were significantly correlated(r=629)

Figure 9 shows a linear correlation between time since death and the increase in potassium in sample 2 of right synovial fluid.

Table No.32 shows the Pearson coefficient of 0.611 of sample 2 of right vitreous potassium and 0.629 of sample 2 of right synovial fluid potassium which has a significant correlation with time since death whereas sodium has negative correlation.

Table No. 33 shows the sodium and potassium values of 31 cases of sample 2 of left eye vitreous and left synovial fluid whose time since death is within 12 hours. Range of TSD is 4-12 hours.

Table No.34 shows the sodium and potassium values of 57 cases of sample 2 of left eye vitreous and left synovial fluid whose time since death is between 12.1- 24 hours. Range of TSD is 13-24 hours.

Table No. 35 shows the sodium and potassium values of 12 cases of sample 2 of right eye vitreous and right synovial fluid whose time since death is more than 24 hours. Range of TSD is 25-103 hours.

Table No. 36 shows total number of cases N, Mean, Standard deviation, standard error, 95% confidence interval for mean and the range of sodium and potassium values of sample 2 of left eye and left knee. Each group have different values (<12 hours, 12.1-24 hours and >24 hours). The table depicts as the time increases level of potassium also increases and $p< 0.001$ which is statistically significant data whereas sodium level falls as time increases. Hence it is not statistically significant.

Table No. 37, 38 shows the regression for sample 2 of left eye vitreous fluid with time since death as a dependent variable. The value of vitreous potassium and time since death were significantly correlated(r=0.567)

Figure 10 shows a linear correlation between time since death and the increase in potassium in sample 2 of left vitreous humour.

Table No. 39, 40 shows the regression for sample 2 of left synovial fluid with time since death as a dependent variable. The value of vitreous potassium and time since death were significantly correlated(r=0.618)

Figure 118 shows a linear correlation between time since death and the increase in potassium in sample 2 of left synovial fluid.

Table No.41 shows the Pearson coefficient of 0.581 of sample 2 of left vitreous potassium and 0.618 of sample 2 of left synovial fluid potassium which has a significant correlation with time since death whereas sodium has negative correlation.

Table No. 42, 43 and 44 show the T-test which compares the sodium and potassium values of sample I of vitreous and synovial fluid on both sides. $p>0.005$ is a non-significant data which concludes there is no difference among the side in respective values.

Table No. 45 shows the comparison of sodium and potassium values of sample 1 and 2 of right and left vitreous and synovial fluid. Statistical analysis

shows P>0.05 which concludes there is no significant difference between right and left values.

Table No. 46 shows the T test which compares the values of sodium and potassium of sample 1 and 2 of right and left vitreous and synovial fluids with timing 0-12 hours. Statistical analysis shows p>0.05 which concludes there is no significant difference.

Table No. 47 shows the T test which compares the values of sodium and potassium of sample I and 2 of right and left vitreous and synovial fluids with timing 12-24 hours. Statistical analysis shows p>0.05 for sodium values which is not significant whereas p<0.05 for potassium is significant.

Table No 48 shows the T test which compares the values of sodium and potassium of sample I and 2 of right and left vitreous and synovial fluids with timing more than 24 hours. Statistical analysis shows p>0.05 which concludes there is no significant difference.

Table No 49 and 50 show the one way ANOVA for comparing sodium and potassium values of both sides for three periods in sample I and sample 2 respectively. It shows p<0.001 which is a statistically significant data which concludes that there is a linear correlation of increase in potassium with time since death.

It has been evident from the statistical analysis of this study that with the increase in time since death potassium levels in vitreous and synovial fluid

keeps on increasing. This observation is confirmed by many studies by Jaffe(1962), Coe(1969), Lie(1967), Farmer(1985), Madea(1989), Bito and Salvador(1970), Adjutantis and Coutselinis(1972), Crowell and Duncan(1974), Komura and Oshiro(1977),Gregora, Kratochvil, Vavrova (1978) Sahoo PC, Mohanty N.K, Nishant A Sheikh-etc.,

It is also evident that there is no significant difference between the values of samples drawn from both the eyes and synovial fluid at the same time. This result is confirmed by various studies done previously by Hughes(1965) , Balasooriya, Hill and Williams(1984) .Mulla et al

Conclusion

CONCLUSION

It has been concluded from this study that there is a linear correlation between time since death and the potassium levels in samples collected from right and left vitreous humour and synovial fluid at different time intervals. There is no significant difference in the values of samples from both the sides. There is also no significant difference between the values of vitreous humour and synovial fluid. The study also concludes that the sodium values are not statistically significant and shows negative correlation with time since death.

References

REFERENCES

1. **Parikh CK(2000),** Personal Identity. In Parikh's Textbook of Medical Jurisprudence.

2. **Dr.Subrahmanyam's** Medical Jurisprudence and Toxicology, (2001), Law publishers (India) Pvt. Ltd.

3. **Dr.K.S.Narayan Reddy,** The Essentials of Forensic Medicine and Toxicology,33rd edition , page 175.and Toxicology, CBS Publishers and Distributors.

4. **Aggarwal RL,Gupta PC and Nagar CK.** Determination of time of death by estimating potassium level in the cadaver vitreous humour. Indian Journal of Ophthalmology 1983 Sep;31(5):528-531.

5. **Donaldson AE ,Lamont IL** (2013) - Biochemical changes that occur after death: Potential markers for Determining Post mortem Interval PloS One 8(11):e82011 doi:10.1371/journal pone.0082011.

6. **Vij K.** Textbook of Forensic Medicine and Toxicology. 2ed:Churchill Livingstone Pvt Ltd; 2002. 144.

7. **Madea B1, Musshoff F-** Postmortem Biochemistry – Forensic Science Int.2007 Jan 17,165(2-3);165-71.Epub 2006, Jun 15.

8. **Coe JI**. Vitreous potassium as a measurement of the post-mortem interval; an historic review and critical evaluation.Forensic Sci Int 1989;42:201-213.

9. **Khurana AK**: Anatomy and physiology of Eye : 85,113,114.

10. **Jacobeic A Fredrick.** Age related changes in vitreous-Structure, Principles and practice of Ophthalmology 2nd edition; 1792-95.

11. **Saugstad OD, Olaisen B.** Postmortem hypoxanthine levels in the vitreous humour, an introductory report.Forensic Sci Int 1978;12:33-36

12. **Sturner, W.Q., & Gantner, G.E.,** Am. J. Clin.Pathol.,42,137,1964.

13. **Dalbhir singh, Rajinder prashad, Chandra prakash, Yogender S Bansal,Suresh Kumar Sharma,Avadh Naresh Pandey**- Linearization of the relationship between serum sodium, potassium concentration, their ratio and time since death in Chandigarh zone of north-west India – fsij 2002, Volume 130, Issue 1, pages1 – 7.

14. **Dr. Singh Dalbir1, Additional Prof. and Head, Dr. Prashad Rajinder2, Associate Professor, Dr. Sharma Suresh Kumar3, Senior Lecturer, Mr. Pandey Avadh Naresh1, Research Fellow** - Analysis of sodium and potassium in vitreous humour have been studied to estimate time since death. Double logarithmic, linear relationship between postmortem vitreous Sodium/Potassium electrolytes concentration ratio and time since death in subjects of Chandigarh zone of northwest India. Forensic Medicine, PGIMER, Chandigarh. Department of Forensic Medicine 2. Deptt. of Biochemistry, PGIMER Chandigarh 3. Deptt. of Statistics, Punjab University Chandigarh Journal of Indian Academy of Forensic Medicine, Year:2005, Volume:27,Issue:3, First page(159) Last page:(165),Print ISSN :0971-0973.

15. **H.V. Chandrakanth, MD , Tanuj Kanchan, MD , B.M.Balaraj, MD, H.S. Virupaksha, MD , T.N. Chandrashekar, MD** Journal of Forensic and Legal Medicine- May 2013 volume 20, Issue 4, Pages 211- 216.

16. **B.A.W. Balasooriya, C.A.St.Hill, A.R. Williams**- The biochemistry of vitreous humour.. A comparative study of the potassium, sodium, urate concentrations in the eyes at identical time intervals after death- FSI - Volume 26, Issue 2,October 1984,Pages 85-91.

17. **Dr.Vishal Garg** –changes in the levels of vitreous potassium with increasing time since death-JIAFM, 2004;26(4).ISSN 0971-0973

18. **W.Q. Sturner, G.E. Ganter** - The postmortem interval; a study of potassium in the vitreous humour - Am J Clin Pathol, 42 (2) (1964), pp. 137–144

19. **W.M.H. Hughes**-Levels of potassium in the vitreous humour after death Med Sci Law, 5 (1965), pp. 150–156

20. **L. Hansson, U. Uotila, R. Lindfors, K. Laiho** Potassium content of the vitreous body as an aid in determining the time of death-J Forensic Sci, 11 (3) (1966), pp. 390–393

21. **J.T. Lie** - Changes of potassium concentration in the vitreous humour after death-Am J Med Sci, 254 (1967), pp. 136–146

22. **M.S. Leahy, E.R. Farber** - Postmortem chemistry of human vitreous humour - J Forensic Sci, 12 (1969), pp. 214–222

23. **B. Madea, C. Henssge, W. Honig, A. Gerbracht** - References for determining the time of death by postmortem vitreous humour – Forensic Sci Int, 40 (1989), pp. 231–243

24. **B. Madea, C. Kreuser, S. Banaschak** - Postmortem biochemical examination of synovial fluid-a preliminary study - Forensic Sci Int, 118 (2001), pp. 29–35

25. **J.I. Coe** - Use of chemical determinations on vitreous humour in forensic pathology-J Forensic Sci, 17 (1972), pp. 541–546

26. **P.G.F. Swift, E. Worthy, J.L. Emery** - Biochemical state of vitreous humour of infants at necropsy-Arch Dis Childhood, 49 (1974), pp. 680–685

27. **S. Komura, S. Oshtro** - Potassium levels in the aqueous and vitreous humor after death-Tohoku J Exp Med,122(1977),pp. 65–68

28. **J.I. Coe** - Postmortem chemistry of blood cerebrospinal fluid and vitreous humor-Tedeschi, Eckert, Tedeschi (Eds.), Forensic medicine, a study in trauma and environmental hazards, vol. II, physical trauma W.B. Saunders Company (1977), pp. 1033–1060

29. **T.A. Blumenfeld, C.H. Mantell, R.L. Catherman, W.A. Blank** -Postmortem vitreous humour chemistry in sudden infant death syndrome and in other causes of death in childhood - Am J Clin Pathol, 71 (1979), pp. 219–223.

30. **E. Choo-Kang, C. McKoy, C. Escoffery** - Vitreous humor analytes in assessing the postmortem interval and the antemortem clinical status - West Indian Med J, 32 (1983), p. 23

31. **J.G. Farmer, Benomran, Watson, W.A. Harland** - Magnesium,potassium, sodium and calcium in postmortem vitreous humour from humans - Forensic Sci Int, 27 (1985), pp. 1–13

32. **M.S. Devgun, J.A. Dunbar** - Biochemical investigation of vitreous; application in forensic medicine, especially in relation to alcohol - Forensic Sci Int, 31 (1986), pp. 27–34

33. **R.J. Stephen, K.G. Richards**- Vitreous humour chemistry. The use of potassium concentration for the prediction of postmortem interval - J Forensic Sci, 32 (2) (1987), pp. 503–509

34. **D.L. Sparks, P.R. Oeltgen, R.J. Kryscio, J.L. Hunsaker** –Comparison of chemical methods for determination of postmortem interval - J Forensic Sci, 34 (1) (1989), pp. 197–206

35. **A.H. Singh** -Potassium concentration analysis in vitreous humour for estimation of time of Death - J Forensic Med Toxicol, 11 (3–4) (1999), pp. 12–16

36. **N. Lange, S. Swearer, W.Q. Sturner** - Human postmortem interval estimation from vitreous potassium; an analysis of original data from six different studies - Forensic Sci Int, 66 (1994), pp. 159–174

37. **B. Knight** - The use of vitreous humour chemistry in timing death, Forensic pathology (2nd ed.) Arnold co-published by Oxford University Press Inc., New York (1996) [pp. 91–94]

38. **G. Govekar, Bishnukumar, P.C. Dikshit, T.K. Mishra** - Study of potassium in vitreous in relation to death interval and cause of death - J Forensic Med Toxicol, 4 (1) (1996), pp. 26–28

39. **R.A. James, Hoadley, B.G. Sampson** - Determination of postmortem interval by sampling vitreous humour - Am J Forensic Med Pathol, 18 (2) (1997), pp. 158–162

40. **D.J. Pounder, D.O. Carson, K. Johnston, Y. Orihara** –Electrolyte concentration differences between left and right vitreous humor samples - J Forensic Sci, 43 (3) (1998), pp. 604–607

41. **B.L. Chaudhary, M. Veena, B.H. Tirpude** - Potassium concentration in vitreous humour in relation to death interval - J Forensic Med Toxicol, 24 (1) (2007), pp. 26–30

42. **Tumram, N.K., Bardale, R.V., Dongre, A.P.** Postmortem analysis of synovial fluid and vitreous humour for determination of death interval: a comparative study. Forensic Sci.Int. 2011;204:186–190.

43. **K.L. Yielding, D. Platt, H.L. Holley**-Synovial Fluid-Comparison of sodium and potassium concentrations in normal and diseased joint fluid - Proc Soc Exp Biol Med,85 (4) (1954), pp. 665–667

44. **D.S. More, M.C. Arroyo** - Biochemical changes of the synovial liquid in corpses with regard to the cause of death. 1. Calcium, inorganic phosphorus, glucose,cholesterol, urea nitrogen, uric acid, proteins, and albumin - J Forensic Sci, 30 (2)(1985), pp. 541–546

45. **P.C. Sahoo, N.K. Mohanty** - Study of sodium, potassium and glucose level in synovial fluid for estimation of death interval - J Forensic Med Toxicol, 15 (1) (1998), pp. 14–16

46. **N.A. Sheikh** - Estimation of potassium interval according to time course of potassium ion activity in cadaveric synovial fluid - Indian J Forensic Med Toxicol, 1(2007), pp. 45–49

47. **Arun K. Siddhamsetty, Satish K. Verma, Anil Kohli, Aditi Verma, Dinesh Puri, Archana Singh**-Exploring time of death from potassium, sodium, chloride, glucose &calcium analysis of postmortem synovial fluid in seemi arid climate-JFLM November 2014 Volume 28, Pages 11-14

48. **Doha Yahia1*, Mohammed A.H. Abd El-Hakiem2**- Biochemical Analysis of Synovial Fluid, Cerebrospinal Fluid and Vitreous Humor at Early Postmortem Intervals in Donkeys- Journal of Advanced Veterinary Research, Volume 4,Issue 1 (2014) 6-11

49. **Sharanagouda M.Arikeri1,, M.R.Laveesh2*, A.V.Neena Priyadarshini1, P.Suja3, U.K.Farsana2,Nisha Michael2, Nithya Raveendran2 –** Determination of time since death by estimating sodium and potassium levels in synovial fluid- Int J Pharm

50. **William MH.** Adler's Physiology of Eye.9th ed. Singapore :Harcourt Brace and Company Asia Pvt Ltd;1992.p.277-278

51. **Roland W.Moskowitz, Roy D.Altman, Marc.G .Hochberg, Joseph A. Buckwater, Victor M. Goldberg –** Osteoarthritis Fourth Edition – Diagnosis and Medical/Surgical Management- Wolters Kluwer – Lippincott Williams & Wilkins.

Annexures

PROFORMA

PM. No :

Token No :

Name :

Age/Sex :

Cause of Death :

Date/Time of Admission :

IP. No :

Date/Time of Death :

Date/Time of First Sample :

Vitreous		Synovial Fluid	
Na	**K**	**Na**	**K**

Date/Time of Second Sample :

Vitreous		Synovial Fluid	
Na	**K**	**Na**	**K**

MASTER CHART-RIGHT SIDE

S.No	Time since Death		Vitreous humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
1	10	12	133.9	133.3	7.2	9.4	127.1	134.7	5.3	6.1
2	4	6	143.2	144.1	6.1	7.1	135.4	143.1	5.2	7.0
3	16	18	141.4	141.8	14.6	15.5	150.7	151.1	10.6	11.2
4	12	15	144.2	144.6	8.2	8.7	146.6	147.4	6.3	7.1
5	18	19	158.7	158.4	6.8	7.8	157.0	156.2	7.4	8.0
6	19	22	149.0	150.8	10.6	13.6	145.2	146.1	8.4	11.5
7	12	13	149.0	151.2	6.8	9.3	149.9	150.0	7.2	10.2
8	13	15	155.6	154.3	8.8	9.0	152.9	151.8	7.1	7.9
9	10	12	146.4	144.7	7.1	7.9	144.7	141.5	7.0	7.3
10	13	15	149.9	151.3	8.6	9.3	151.1	151.3	8.7	8.8
11	7	12	146.2	148.4	7.0	7.2	138.4	137.7	5.8	7.4
12	19	20	142.6	141.9	10.2	11.0	137.0	136.5	7.6	8.1
13	15	17	145.7	144.6	10.7	10.9	139.5	138.2	9.8	10.0
14	9	10	152.9	154.3	6.1	6.1	150.3	152.3	7.0	7.0
15	18	21	141.7	140.9	9.1	9.9	140.7	140.2	7.3	8.2
16	11	15	152.5	150.8	7.9	8.4	145.6	145.0	7.0	8.1
17	17	22	143.2	141.3	8.6	8.9	137.8	135.9	9.9	10.2
18	14	19	153.7	150.5	10.6	11.8	147.7	144.6	9.9	11.0
19	17	18	154.3	154.1	7.3	7.6	151.7	151.3	5.4	5.5
20	21	24	149.9	145.5	10.5	11.7	152.4	137.4	7.9	8.7
21	2	4	147.3	144.9	6.8	7.4	150.5	150.7	5.3	5.5
22	3	6	157.9	149.5	7.5	8.6	152.3	144.2	6.8	7.7
23	24	29	144.2	141.2	11.9	13.2	144.5	139.0	11.5	12.3
24	31	33	147.9	147.5	7.2	7.9	148.5	146.6	7.0	7.6
25	18	21	153.2	151.8	7.8	8.0	152.9	150.8	7.6	7.9
26	9	12	127.7	136.3	9.4	9.8	134.2	127.1	9.6	9.8
27	12	15	150.9	156.7	9.1	10.3	147.4	145.6	9.1	11.8
28	14	16	146.9	148.2	7.3	9.0	148.5	151.6	7.0	8.1
29	18	20	135.7	142.9	11.3	12.0	135.1	140.3	9.0	9.8
30	12	13	145.5	158.3	12.2	13.0	144.2	148.7	12.6	12.9
31	20	22	138.3	147.3	9.4	10.3	145.1	151.6	9.8	10.8
32	27	29	139.5	148.7	10.1	11.3	139.7	148.1	10.2	10.5
33	12	15	141.2	144.2	11.9	13.2	144.5	139.0	10.5	12.3
34	48	53	132.7	128.4	13.2	14.6	132.5	129.0	12.9	14.3
35	102	103	125.7	126.8	16.3	17.5	124.6	123.8	15.6	16.2

S.No	Time since Death		Vitreous humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
36	14	20	137.2	133.9	8.3	8.5	132.5	129.3	6.6	6.8
37	15	17	149.4	148.6	5.8	6.8	144.0	143.5	5.6	6.3
38	29	32	143.2	141.5	8.6	8.9	137.8	138.4	9.9	12.0
39	7	10	127.7	136.3	9.4	9.8	134.2	137.8	9.6	10.2
40	10	13	155.4	165.8	12.7	14.1	154.8	156.7	11.4	12.4
41	15	18	128.3	136.8	7.0	8.3	131.9	132.8	5.6	6.2
42	36	38	133.8	139.5	15.1	18.1	136.7	142.6	13.4	16.1
43	8	12	137.5	136.2	12.7	14.7	144.5	143.1	8.2	9.4
44	8	9	138.5	138.7	6.7	7.0	138.8	142.2	6.4	6.6
45	10	11	139.7	145.1	4.8	4.9	140.8	146.2	5.3	5.7
46	10	12	150.9	156.7	9.1	9.3	147.4	145.6	9.0	9.1
47	12	13	154.2	152.0	18.6	19.1	153.5	151.3	17.9	18.8
48	9	11	147.3	145.2	9.2	9.4	142.3	144.1	8.8	9.4
49	22	23	125.1	128.5	9.1	9.2	123.3	125.6	8.0	8.2
50	28	32	138.7	136.5	7.3	8.0	136.6	134.0	6.9	7.4
51	20	22	158.3	156.8	10.5	11.1	154.5	152.0	9.8	10.4
52	2	7	128.4	130.6	3.4	6.2	129.5	132.4	3.1	5.9
53	4	7	132.5	145.6	5.1	6.9	133.2	146.1	5.3	6.8
54	15	19	141.2	146.7	8.7	9.4	138.9	146.4	8.3	9.2
55	14	21	139.8	145.4	7.5	10.0	136.5	143.5	7.2	9.8
56	5	9	129.6	135.6	6.4	7.1	130.2	136.6	5.7	7.0
57	20	23	134.5	133.2	9.7	10.4	132.2	130.2	8.8	9.8
58	3	14	128.3	136.5	4.5	9.6	130.2	138.1	4.6	10.0
59	2	7	126.5	132.4	2.9	6.0	128.7	131.9	3.2	5.9
60	11	15	145.1	146.9	7.3	8.5	148.0	145.6	7.0	8.2
61	18	24	146.5	143.2	7.4	9.2	146.0	142.8	7.0	8.9
62	5	11	138.9	140.4	4.5	8.2	136.8	137.8	5.4	7.8
63	6	8	138.4	138.9	7.8	9.1	136.6	139.1	7.6	9.0
64	12	16	145.2	146.3	7.5	9.3	141.2	146.0	6.9	8.9
65	5	7	128.9	136.0	5.6	7.7	127.7	138.0	6.2	7.6
66	2	6	128.1	132.4	3.8	5.5	132.8	132.7	3.7	5.3
67	3	62	129.1	134.8	4.3	14.9	130.1	135.2	4.5	14.3
68	13	15	143.6	145.2	7.5	8.7	141.2	143.5	7.2	8.2
69	10	15	139.9	143.5	7.4	8.7	138.6	142.0	7.0	7.9
70	6	13	130.2	136.7	5.0	7.8	131.2	135.6	4.6	7.4
71	2	9	126.5	134.7	3.2	6.5	128.8	135.6	3.1	6.3
72	12	21	145.2	140.4	7.2	11.0	142.3	141.2	6.8	10.5

S.No	Time since Death		Vitreous humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
73	10	14	142.7	138.9	7.2	8.4	141.2	140.3	6.5	7.7
74	3	8	127.3	130.7	4.6	6.5	130.2	132.4	4.3	6.1
75	13	14	137.8	136.4	7.8	8.2	135.6	137.8	7.3	7.9
76	20	24	151.2	145.6	11.8	12.4	149.9	148.3	11.9	12.8
77	13	14	141.2	142.3	7.5	8.2	138.6	141.6	7.2	8.2
78	7	11	153.4	152.8	6.8	7.2	149.8	151.7	6.5	7.0
79	11	15	143.5	150.2	6.7	7.4	145.8	149.7	6.4	6.9
80	17	19	154.6	153.8	8.6	9.4	152.6	153.4	8.8	9.7
81	4	6	129.8	135.5	6.1	7.2	128.4	136.3	5.8	6.5
82	14	45	152.2	149.4	7.5	14.9	148.6	144.2	7.7	15.0
83	2	6	127.6	135.6	3.5	5.4	129.8	136.4	3.6	5.4
84	8	9	138.8	139.2	6.9	8.7	136.8	138.7	6.3	8.2
85	18	24	139.8	141.2	7.5	9.2	140.1	144.3	7.1	8.9
86	5	50	129.7	135.8	5.2	14.6	130.1	138.8	4.5	13.7
87	15	17	145.3	147.8	7.9	8.9	144.3	148.0	7.6	9.6
88	12	17	145.6	151.2	6.7	8.3	146.0	149.2	6.4	8.7
89	7	11	130.1	135.4	4.9	8.0	133.7	135.6	4.6	7.4
90	7	14	148.9	147.7	6.2	8.9	138.2	142.7	5.6	8.2
91	12	18	151.1	147.8	7.5	9.8	145.6	142.3	6.9	9.2
92	1	25	127.5	145.6	2.9	10.8	126.5	144.3	2.8	10.7
93	6	12	145.6	147.8	6.4	6.9	150.2	152.0	5.9	7.2
94	3	10	129.7	141.6	3.9	6.7	132.4	141.6	4.2	7.6
95	13	19	147.8	144.3	7.3	10.2	151.1	146.7	7.9	10.7
96	17	20	150.2	151.3	10.2	11.3	148.9	152.3	9.8	10.2
97	18	21	152.8	151.8	7.8	8.0	153.9	150.8	7.6	7.9
98	15	20	149.8	152.3	8.8	10.2	148.6	148.8	8.5	9.6
99	15	21	134.5	136.7	10.5	11.2	137.8	141.2	9.5	10.8
100	13	16	145.8	143.7	7.5	8.6	147.6	144.2	6.8	8.0

MASTER CHART-LEFT SIDE

S. No	Time since Death		Vitreous Humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
1	10	12	133.6	132.9	7.1	9.1	126.9	134.4	5.4	6.1
2	4	6	143.0	144.5	6.4	7.5	142.9	144.3	5.1	6.9
3	16	18	141.6	142.0	14.9	15.8	150.3	150.8	11.0	11.4
4	12	15	143.8	144.4	8.1	8.5	147.1	147.5	6.2	6.9
5	18	19	159.0	158.5	6.7	7.8	156.8	156.2	7.5	8.1
6	19	22	149.2	150.6	10.7	12.8	144.0	144.6	7.8	10.9
7	12	13	148.9	151.0	7.0	8.5	150.5	150.0	6.9	10.0
8	13	15	155.9	154.1	8.9	9.0	153.4	152.2	6.9	7.8
9	10	12	146.6	145.1	6.8	7.7	145.6	140.8	6.8	7.1
10	13	15	150.2	151.2	8.4	8.9	149.7	150.3	8.4	8.9
11	7	12	147.0	149.0	6.5	7.1	136.7	138.2	6.2	6.9
12	19	20	142.4	142.0	10.1	10.3	138.4	136.7	7.4	7.8
13	15	17	146.0	145.1	10.3	10.7	141.1	139.8	9.2	9.5
14	9	10	153.0	153.9	5.8	6.1	151.8	149.7	6.8	7.4
15	18	21	142.0	141.2	8.6	9.5	139.7	138.6	6.9	7.8
16	11	15	152.8	151.4	8.2	8.5	150.8	151.7	7.2	8.2
17	17	22	144.0	141.0	8.4	8.8	139.4	137.8	9.7	9.9
18	14	19	154.0	150.9	11.0	12.1	145.9	145.6	9.8	10.7
19	17	18	154.1	154.2	7.7	7.9	153.2	150.9	6.2	6.5
20	21	24	150.1	144.9	9.9	11.5	149.8	142.6	8.2	8.9
21	2	4	147.8	145.1	7.0	7.5	149.8	147.9	6.2	5.8
22	3	6	158.0	150.2	7.2	7.9	152.5	147.4	6.9	7.5
23	24	29	144.1	141.1	11.4	12.8	144.5	138.6	11.7	11.9
24	31	33	148.1	147.8	6.9	7.8	149.1	147.2	6.8	7.4
25	18	21	153.4	152.0	7.5	8.3	153.2	151.5	7.4	8.1
26	9	12	128.4	136.5	9.1	9.7	135.5	130.2	8.9	9.6
27	12	15	151.5	156.9	9.5	9.9	148.2	146.3	9.3	11.2
28	14	16	147.2	148.6	6.9	8.9	149.7	152.3	7.1	8.6
29	18	20	136.2	143.2	11.1	11.9	136.0	138.0	9.2	9.9
30	12	13	145.6	158.0	11.8	13.4	146.5	147.8	12.2	12.7
31	20	22	138.7	148.0	8.9	9.8	144.8	147.4	9.7	10.9
32	27	29	140.1	148.3	10.0	11.5	142.2	150.3	10.4	10.9
33	12	15	140.8	144.1	11.4	11.8	141.1	145.0	11.2	11.7
34	48	53	133.1	135.6	13.0	13.8	134.9	134.0	11.8	13.7
35	102	103	126.0	126.3	14.9	15.8	127.2	128.2	14.9	15.6

S. No	Time since Death		Vitreous Humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
36	14	20	137.4	134.0	7.9	8.2	137.1	135.5	7.1	7.4
37	15	17	150.1	149.3	6.3	6.8	150.2	148.8	6.2	6.7
38	29	32	143.1	140.8	8.3	8.8	142.5	141.0	9.2	11.6
39	7	10	128.0	136.1	9.8	10.4	126.8	135.3	8.9	9.8
40	10	13	155.1	165.3	13.2	13.6	154.2	159.5	12.2	12.8
41	15	18	128.7	136.7	7.0	7.6	126.5	135.2	6.2	6.4
42	36	38	133.2	140.2	14.3	17.7	132.8	138.3	12.7	14.9
43	8	12	138.0	136.0	13.2	13.9	146.7	145.5	8.0	9.2
44	8	9	139.1	139.0	6.4	6.6	141.2	143.4	6.5	6.6
45	10	11	139.7	144.9	5.0	5.2	138.6	143.2	5.1	5.3
46	10	12	150.6	156.4	9.0	9.5	148.8	154.5	8.9	9.1
47	12	13	153.8	152.0	18.7	18.9	152.8	152.0	18.5	19.2
48	9	11	147.1	144.8	9.3	9.6	147.4	145.6	8.9	9.2
49	22	23	124.8	128.3	8.5	8.6	124.5	127.6	7.9	8.5
50	28	32	139.2	136.7	7.1	7.5	137.6	138.2	7.0	7.4
51	20	22	158.4	156.6	10.0	10.5	156.4	157.2	9.2	9.5
52	2	7	128.2	131.1	3.2	6.1	127.9	135.6	3.0	6.0
53	4	7	132.4	144.8	5.2	6.7	133.1	143.6	5.3	6.8
54	15	19	140.9	146.5	8.6	9.4	138.4	145.9	8.3	9.0
55	14	21	140.1	145.6	7.4	10.4	135.9	144.3	7.1	9.6
56	5	9	129.8	136.0	6.5	7.3	130.4	137.0	5.8	6.9
57	20	23	134.6	135.2	9.5	10.3	132.0	131.8	8.6	9.7
58	3	14	127.9	136.2	4.7	9.5	129.7	139.0	4.6	9.6
59	2	7	126.3	132.0	3.1	5.9	128.5	132.0	3.0	6.0
60	11	15	144.8	147.0	7.2	8.4	147.8	146.0	6.8	7.4
61	18	24	145.9	146.0	7.2	8.8	146.2	146.3	7.0	8.7
62	5	11	140.0	145.6	4.6	7.9	139.2	141.2	4.9	7.8
63	6	8	138.4	139.2	7.6	8.9	136.7	140.0	7.8	9.0
64	12	16	144.9	146.1	7.3	9.2	140.9	145.9	6.5	9.0
65	5	7	130.0	135.6	5.4	7.6	129.2	133.4	6.0	7.3
66	2	6	127.8	131.8	3.9	5.4	132.6	132.6	3.8	5.6
67	3	62	130.0	135.0	4.2	14.7	129.9	134.8	4.5	13.9
68	13	15	143.8	145.0	7.3	8.5	140.9	143.2	7.3	8.2
69	10	15	140.1	143.4	7.3	8.7	138.5	141.9	7.1	8.0
70	6	13	130.0	137.0	5.2	7.6	131.1	136.2	4.7	7.4
71	2	9	126.4	134.5	3.2	6.4	129.0	135.3	3.2	6.2
72	12	21	145.1	141..1	6.9	10.7	142.0	141.0	6.7	11.0
73	10	14	142.5	139.0	7.0	9.0	141.6	144.2	6.8	8.2

S. No	Time since Death		Vitreous Humour				Synovial Fluid			
			Na		K		Na		K	
	X1	X2	1	2	1	2	1	2	1	2
74	3	8	127.1	131.0	4.5	6.3	130.5	132.1	4.2	6.0
75	13	14	138.1	137.7	7.6	8.0	135.7	137.6	7.3	8.1
76	20	24	150.8	146.0	11.5	12.5	150.0	148.0	12.1	12.8
77	13	14	141.0	141.8	7.6	8.1	141.1	142.0	7.1	8.2
78	7	11	152.3	153.8	6.5	7.4	150.1	152.0	6.6	7.2
79	11	15	143.2	148.9	6.4	7.3	146.0	150.0	6.5	6.7
80	17	19	154.4	152.8	8.4	9.2	152.6	154.4	8.7	8.9
81	4	6	130.1	133.5	6.0	7.0	127.9	135.3	5.9	6.3
82	14	45	151.9	149.2	7.1	14.6	149.3	143.9	7.5	14.2
83	2	6	127.8	135.7	3.7	5.3	130.2	135.3	3.8	5.6
84	8	9	139.0	140.1	6.9	8.6	136.5	138.4	6.1	8.0
85	18	24	140.0	144.2	7.2	8.8	140.1	144.3	7.1	8.7
86	5	50	130.1	135.8	5.0	14.7	130.1	140.4	5.1	13.8
87	15	17	146.1	147.2	8.0	8.7	144.3	148.4	7.9	9.2
88	12	17	144.8	152.2	6.9	8.3	143.0	149.2	6.3	8.6
89	7	11	131.2	134.8	5.1	7.7	132.9	135.6	4.9	7.6
90	7	14	149.0	146.7	6.1	8.7	138.3	141.9	5.8	8.0
91	12	18	151.1	149.1	7.3	10.0	144.9	145.1	7.0	9.4
92	1	25	128.1	145.9	3.3	10.6	126.5	145.3	3.1	10.5
93	6	12	145.6	148.1	6.2	6.9	151.0	152.2	5.9	7.1
94	3	10	130.1	141.8	4.1	6.8	132.5	141.7	4.5	7.5
95	13	19	147.9	143.8	7.1	10.3	149.4	144.7	7.9	10.4
96	17	20	149.9	150.3	10.2	10.8	149.0	152.2	9.6	10.1
97	18	21	151.8	152.8	7.8	8.2	153.6	150.5	7.3	7.6
98	15	20	150.0	152.3	8.7	10.3	148.8	149.4	8.3	9.2
99	15	21	135.1	136.3	10.6	11.4	138.2	142.2	9.4	10.5
100	13	16	145.7	144.1	7.4	8.8	146.7	147.2	6.8	8.3